CURRICULUM VITAE

Philipp R. Heck, *Ph.D.*
April 10, 2021

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Field Museum of Natural History
1400 S Lake Shore Dr, Chicago, IL
60605-2496, USA

SUMMARY

Education: Ph.D., Earth Sciences, ETH Zurich 2005; M.S., Earth Sciences, ETH Zurich 2001.

Professional experience: Interim Director, Negaunee Integrative Research Center, Field Museum Chicago (2021-); Professor (part-time), Univ. of Chicago (2021-); Head, Earth Science, Field Museum, Chicago (2020); Robert A. Pritzker Curator, Field Museum, Chicago (2020-); Associate Professor (part-time), Univ. of Chicago (2015-2020); Associate Curator, Field Museum, Chicago (2013-2020); Assistant Curator, Field Museum, Chicago (2010-2013); Postdoc: Univ. of Chicago (2009-2010); Univ. of Wisconsin, Madison (2008-2009); Max-Planck Institute for Chemistry, Mainz (2005-2007); Research Assistant, ETH Zurich (2002-2005); Diploma Researcher (1999-2001); Administrator, Andrew Corp. (1993-1994).

Publications: 67 peer-reviewed publications; 132 conference abstracts (as of April 10, 2021).

Grants: $2.3 Mio: 5 NASA ($1.6 Mio.), 1 NSF ($123,000), 6 internal ($571,000).

Training/Teaching: 2 postdocs advised; 10 graduate students; 15 undergraduate interns; 5 different courses taught at University level; 35 invited talks at scientific institutions and conferences. Track record of hiring diverse colleagues from women and minorities. Organizing grant writing workshops and promoting equity, inclusion, and diversity.

Specializations: Leading collaborative research projects in cosmochemistry; presolar grains; cosmic dust; early solar system processes; fossil meteorites and micrometeorites; isotope geochemistry; micro- and nanoanalysis; mass spectrometry (SIMS, APT, noble gas mass spectrometry, LA-ICP-MS,); electron microscopy; Raman spectroscopy; XRF; µCT.

Outreach and science communication: Frequent appearance in national and international news media (New York Times, Washington Post, BBC News, NPR, CNN, ABC, NBC, CBS, Fox News, Al Jazeera); 25-50 public outreach events annually; providing Field Museum exhibit content for ~1.3 M visitors annually.

HIGHER EDUCATION

Ph.D., Earth Sciences/Natural Sciences, ETH Zurich (Switzerland) 2002 – 2005
Cosmochemistry; noble gas mass spectrometry and secondary ion mass spectrometry of nucleosynthetic isotopes and cosmogenic nuclides.

M.S., Earth Sciences/Natural Sciences, ETH Zurich (Switzerland) 2001
Marine geochemistry and sedimentology; EPMA; stable isotope mass spectrometry

Studies of Earth Sciences at ETH Zurich (Switzerland) 1996 – 2001
M.S. (Dipl. Natw. ETH)

Geochemistry, Sedimentology, Paleooceanography, and Micropaleontology.
Studies of Physics at University of Geneva (Switzerland) **1995 – 1996**
Physical Laboratory Certificate

POSITIONS IN ACADEMIA

Interim Director, Negaunee Integrative Research Center **2021-present**
The Field Museum of Natural History, Chicago

Head (Chair), Earth Sciences section (formerly known as Geology Dept.), **Feb – Dec 2020**
Negaunee Integrative Research Center, Field Museum

Robert A. Pritzker Curator for Meteoritics and Polar Studies **Nov 2020-present**
Tenured curator-in-charge for meteorites, minerals and terrestrial rocks. **Head** of the Robert A. Pritzker Center for Meteoritics and Polar Studies, Science & Education, The Field Museum of Natural History, Chicago. Chair, Science and Scholarship Funding Committee.

Robert A. Pritzker Associate Curator for Meteoritics and Polar Studies **2013–present**
Tenured curator-in-charge for meteorites, minerals and terrestrial rocks. **Head** of the Robert A. Pritzker Center for Meteoritics and Polar Studies, Science & Education, The Field Museum of Natural History, Chicago. Chair, Science and Scholarship Funding Committee.

Professor (part-time), Department of the Geophysical Sciences and the College, The University of Chicago, Chicago, IL. **2021 –present**

Associate Professor (part-time), Department of the Geophysical Sciences and the College, The University of Chicago, Chicago, IL. **2015 –2020**

Associate, Department of the Geophysical Sciences, The University of Chicago **2010 – 2015**

Robert A. Pritzker Assistant Curator **Mar 2010 – Aug 2013**
Tenure-track curator-in-charge for meteorites, minerals and terrestrial rocks. Head of the Robert A. Pritzker Center for Meteoritics and Polar Studies at the Department of Geology, The Field Museum of Natural History, Chicago.

Post-Doctoral Scholar **Mar 2009 – Feb 2010**
The Chicago Center for Cosmochemistry and Department of the Geophysical Sciences, The University of Chicago; Advisor: Prof. Dr. Andrew M. Davis

Post-Doctoral Research Associate **Jan 2008 – Feb 2009**
Wisc SIMS Laboratory, Department of Geology & Geophysics, University of Wisconsin, Madison; Advisors: Prof. Dr. John Valley, Dr. Noriko Kita

Guest Researcher **Dec 2007**
Noble Gas Laboratory, Department of Earth Sciences, ETH Zurich (Switzerland)

Post-Doctoral Fellow **2005 – 2007**
Max-Planck-Institute of Chemistry, Mainz (Germany)
Advisor: Dr. Peter Hoppe

Research Assistant **2002 – 2005**
Institute of Isotope Geology and Mineral Resources, ETH Zurich

Diploma Researcher **1999 – 2001**
Geological Institute, ETH Zurich

INSTRUMENTATION/TECHNIQUES: NANO- AND MICROANALYSIS

- Noble gas mass spectrometry, atom-probe tomography: Expert user, development of novel applications and data analysis procedures.
- Scanning Electron Microscopy/X-Ray Spectroscopy/Electron Microprobe, focused ion beam sample preparation, Secondary Ion Mass Spectrometry (Cameca IMS 1280 and NanoSIMS), Laser Raman Spectroscopy: Expert user.
- Laser Ablation Quadrupole Inductively Coupled Plasma Mass Spectrometry, X-Ray Fluorescence Spectroscopy and X-ray microCT: user.
- Wet chemistry lab/mineral isolation, geological sample preparation for microanalysis: expert, development of new procedures.

TEACHING EXPERIENCE

Courses Taught at University Level

Research & Reading Course, "Early solar system processes", Dept. of the Geophysical Sciences, The University of Chicago **2017–2020**

Course 20500/30500; 22600 "The Accretion of Extraterrestrial Matter Throughout Earth's History", The University of Chicago **2016, 2018, ~~2020*~~**
**2020 course cancelled by University due to the pandemic*

Guest Lectures "Atom Probe Tomography" and "Noble Gas Mass Spectrometry", Dept. of the Geophysical Sciences, The University of Chicago **2010, 2013, 2015**

Research & Reading Course, "Meteorite Classification", Dept. of the Geophysical Sciences, The University of Chicago **2015, 2017, 2018**

Lecture and laboratory course "Astrophysics: Meteorites", Institute of Astronomy, ETH Zurich. **2002 – 2005**

Practical course "Meteorites" as part of the lecture "Planetology", **2002**

Department of Earth Sciences, ETH Zurich.

Lectures and practical courses on selected topics in Astronomy, Urania Observatory, Public University of Zurich (Switzerland). **1995 – 2005**

Lecture 0110-01 "The Search for Extraterrestrial Intelligence", Public University of Zurich. **2005**

Lecture 0603 "The New Solar System", Public University of Zurich. **2002**

Work advised at University Level

Main advisor of postdoctoral research scientists

Dr. Maria Valdes, Meeker Postdoctoral Fellow. The Field Museum. Ca and O isotopes of HED meteorites and micrometeorites. **Dec 2019-present**

Dr. Surya Snata Rout, The Field Museum: TEM and atom-probe tomography of iron meteorites, TEM and Raman spectroscopy of shocked minerals, SIMS oxygen isotopic analysis of detrital chromites. **Sep. 2013 – May 2017**

Co-advisor and collaborator of postdoctoral scholar Dr. Levke Kööp, The University of Chicago: Noble gas mass spectrometry and SIMS on meteoritic hibonite and spinel. **2016 – 2018**

Committee member of the graduate students at the University of Chicago:

- Mr. Xin Yang (main advisor: 2019-present): early solar system processes recorded in components of primitive carbonaceous chondrites.

- Ms. Jennika Greer (main advisor: 2016-present): atom-probe tomography of lunar ilmenite to investigate space weathering at the nanoscale. Isolation and identification of presolar grains (chemical separation, EDS mapping, Raman spectroscopy, SIMS). Chronology of presolar silicon carbide through interstellar cosmic-ray exposure age dating. SIMS and atom-probe tomography of presolar grains.

- Ms. Hannah Bloom (2021-present): Presolar grains and refractory minerals.

- Mr. Andrew Heard (2016-present): Petrology and geochemistry of banded iron formations. Microbands with these rocks have been suggested to represent seasonal changes in chemical sedimentation. Testing hypotheses for the repetitive nature of the bands may address outstanding questions as to their origins and the pace of their deposition.

- Mr. Mingen Augustin Pan (2016-2018): Formation of amoeboid olivine aggregates and isotopic fractionation processes in cosmic spherules. A petrological and geochemical

study. Electron microscopy and secondary ion mass spectrometry.

- Ms. Krysten Villalon (2014-present): Isotopic compositions of presolar silicates and cometary GEMS (Glass with Embedded Metal and Sulfide).

- Ms. Levke Kööp (co-advisor with A. M. Davis: 2012-2016): Multielemental isotopic compositions of early solar system minerals spinel and hibonite. Electron microscopy and secondary ion mass spectrometry.
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Committee member and co-advisor of other graduate students: Mr. James Holstein (2013-2015, Lund University, Sweden; chemistry of chromites and spinels of unequilibrated ordinary chondrites), Ms. Karolina Bjärnborg (2010-2012, Lund University, Sweden; chemistry of chromites and spinels of carbonaceous chondrites), Mr. Matthias M. M. Meier (2006-2011, ETH Zürich, Switzerland; noble gas cosmochemistry of presolar grains and fossil micrometeorites).

Mentorships: doctoral student Mr. Reto Trappitsch (2010-2013, University of Chicago; presolar grains), Ms. Sara Rastegar (2015-2016, Northwestern University; presolar grains), Mr. Jason Huberty (2008-2009, University of Wisconsin; banded iron formations).

Supervisor of undergraduate interns: Thomas Cortellesi (2021; University of Chicago); Katarina Keating (2019-2020; University of Chicago), Kevin Eisenstein (2019; Northwestern University); Shannon Sheu (2019, University of Chicago), Ben Shafer (2018, University of Chicago), Nick Sitaras (2017-2018, University of Chicago), Ali Sultan (2014-2015, Benedictine University), Melissa Clark (2015, Bryn Mawr), Emily Levin (2014-2015, Northwestern University), Katie Jaycox (2014, Northwestern University), Kaitlyn McCain (2013-2015, University of Chicago), Eleanor Albarran (2012, Princeton University), Maria Valdes (2012, University of Chicago), Asna Ansari (2011, Northwestern University), Brit Hvide (2011, Northwestern University).

AWARDS AND HONOURS

$515,863 PI on NASA Emerging Worlds Award	**2021-2023**
$200,000 PI on Polar Studies Award (Field Museum)	**2021**
$55,000 PI on Field Museum Science Innovation Award	**2020**
$133,655 Co-I on NASA Solar System Workings Award	**2020-2022**
$30,000 PI on Field Museum Seed Fund Award	**2020**
$499,517 PI on NASA Emerging Worlds Award	**2019 – 2021**
Chicago Innovation Award (Project Aquarius Science Team Member)	**2018**
Microanalysis Society Cosslett Award	**2017**
$9,590 PI on Polar Studies Award (Field Museum)	**2017**
$123,400 Co-PI on NSF MRI for new LA-Q-ICPMS at Field Museum	**2015**
$276,000 PI on NASA Cosmochemistry Grant Award	**2014 – 2018**
NASA Group Achievement Award, Interstellar Stardust PE consortium	**2013**
$250,000 Co-I on award from Tawani Foundation (Antarctica)	**2012**
$26,160 PI on award from the Negaunee Foundation	**2012**

$168,000 PI on NASA Cosmochemistry Grant Award 10-COS10-0029	**2011 – 2014**
Postdoctoral Fellowship from the Max-Planck-Society (Germany)	**2005 – 2007**
Doctoral Research Grant, ETH Zurich	**2002 – 2005**

Notophyllia hecki **2004**

A newly discovered species of ahermatypic, solitary coral was named in recognition of Philipp R. Heck, who collected and made available for study a large collection of deep-water corals from the Marion Plateau, North-East Australia (Cairns, S. D. The Azooxanthellate Scleractinia (Coelenterata: Anthozoa) of Australia, *Records of the Australian Museum* **56**(3), 259-329 (2004)).

SERVICES TO THE SCIENCE COMMUNITY AND OTHER SCIENTIFIC ACTIVITIES

Committees and Expeditions

Strategic Planning Core Group, Field Museum	**2021**
Search Committee Member, Field Museum Paleontology Curator	**2021**
Search Committee Member, Field Museum CEO and President	**2019–2020**
PI on Polar Studies Expedition to Antarctica	**2020–2022**
Proposal Evaluation Board, Center for Nanoscale Materials, Argonne National Laboratory	**2020-present**
Search Committee Member, Field Museum Fossil Reptile Curator	**2019**
Chair of the Field Museum's Science and Scholarship Funding Committee	**2015-2020**
Co-I, science team, CONDOR, a Comet Sample Return Mission proposed to NASA's New Frontier Program	**2016–2017**
Panel chair, NASA Research & Analysis Programs	**2015, 2016, 2019**
NASA review panels for Research & Analysis Programs and Planetary Missions	**2011–2019**
Advisor to the Geological Survey of India and expedition member of the first Indian Antarctic Meteorite Prospecting Expedition	**2012**
Argonne National Lab, Electron Microscopy Center Users Executive Committee	**2011–2014**
Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM) Stardust Mission subcommittee member	**since 2011**
Interstellar Preliminary Examination Team of the NASA Stardust mission	**2010–2014**
Preliminary examination team for comet dust, NASA Stardust mission	**2006**
Field Museum's Scanning Electron Microscope Committee	**since 2012**
Field Museum's Scholarship Committee	**2010-2020**
Field Museum Tawani Polar Expedition Fund Committee	**since 2010**

Service for Conferences

Chair, Organizing Committee of the Meteoritical Society's Annual Meeting 2021	**since 2017**
Local organizing committee, NASA Astrobiology Conference, Chicago	**2015**
Session chair "W304: Presolar, Interplanetary, and Cometary Dust", 46th Lunar and Planetary Science Conference, The Woodlands, TX	**2015**
Co-convener "The Solar System and its Stellar Environment", 1a, Goldschmidt Conference 2014, Sacramento, CA	**2014**
Co-chair, Electron Microscopy Center plenary session at the Argonne Users Meeting	**2014**

Co-chair, "Aqueously altered carbonaceous chondrites: from stardust to Ceres" at the Meteoritical Society Annual Meeting in Edmonton, Canada **2013**
Program committee for the Argonne National Laboratory Users Meeting **2012, 2013, 2014**
Program committee for the Lunar and Planetary Science Conference **2012**
Co-chair of the presolar grains session at the Lunar and Planetary Science Conference **2012**
Convener, "Extraterrestrial Dust: Laboratory Analysis of Mission-Returned Samples and Hypervelocity Dust Impacts", P15, at the AGU Fall Meeting **2011**
Co-chair, "Presolar Materials" session at the *72nd Annual Meteoritical Society Meeting*, Nancy, France **2009**
Local organization team, Goldschmidt Conference 2002, Davos (Switzerland). **2002**
Head, "2nd European Symposium on the Protection of the Night Sky", Lucerne, Switzerland, under the patronage of UNESCO. **2002**

Other Service and Activities
Curation of the Field Museum's meteorite and physical geology collection **since 2010**
Curator for new Field Museum's new Meteorite Exhibit **2017**

Peer reviewer for *NASA Research & Analysis Programs, National Science Foundation, European Research Council, Japanese Space Exploration Agency (JAXA), Nature Communications, Meteoritics & Planetary Science, Geochimica et Cosmochimica Acta, Geological Society of America, Chemie der Erde, Icarus, Geology, Astrophysical Journal, Planetary & Space Science, Journal of the Geological Society, Geosciences, Minerals.* **since 2006**

Participation on an Ocean Drilling Program Site Survey Cruise, Australian Geological Survey Organisation (now Geosciences Australia), NE Australian Shelf with the Australian Research Vessel "Franklin". **1999**

Coral reef monitoring "Reef Check" during the El Niño Year, Maldives, part of the UN Global Coral Reef Monitoring Network. **1998**

RELEVANT EXTRACURRICULAR ACTIVITIES

Co-founder and president of Dark-Sky Switzerland (NGO), an interdisciplinary working group of the Swiss Astronomical Society to reduce light pollution; Swiss section of the International Dark-Sky Association (IDA). Executive Director Special Award of the IDA 2003; Honorary Presidency since 2006. **1996 – 2006**

Guide at the Urania Observatory, Public University of Zurich. **1995 – 2005**

Numerous appearances in several public science contributions on local, national, international television and radio, in newspapers and magazines. **1993 – present**

Editor and author of publications for popular astronomy Swiss magazines "astro sapiens", "Orion", and www.astroinfo.org, **1993 – 2004**

a major service for amateur astronomers in German language.

Conception and organization of a practical course **1995 – 1996**
"Introduction to Astronomy for Youths" for the Swiss Astronomical Society.

Administrator, Andrew Corporation, Bachenbülach (Switzerland). **1993 – 1994**

LANGUAGE SKILLS

- English: Working language; proficient in written and spoken form.
- German: Mother tongue.
- French: Fluent in written and spoken form.

COMPUTER PROFICIENCY

- Proficiency with a large variety of computer applications (such as data analysis and visualization tools, mass spectrometry software, office applications, database management) and operating systems (Mac OS, Windows, Unix/Linux)
- Working knowledge of programming and script languages (e.g. Ionic script language for noble gas mass spectrometry protocols, Basic, Pascal, Modula, Oberon)

MEMBER OF THE FOLLOWING PROFESSIONAL SOCIETIES

- American Association for the Advancement of Science
- American Geophysical Union
- Meteoritical Society
- Microanalysis Society
- Microscopy Society of America
- SwissSed (Swiss Sedimentologists)

PEER-REVIEWED PUBLICATIONS

**Denotes student author (co-)advised; [#]denotes post-doctoral scholar (co-)advised by Philipp R. Heck.*

67. Nie N. X., Dauphas N., Alp E. E., Zeng H., Sio C. K., Hu J. Y., Chen X., Aarons S. M., Zhang Z., Tian H.-C., Wang D., Prissel K. B., **Greer J.***, Bi W., Hu Mi. Y., Zhao J., Sharar A., Roskosz M., Teng F.-Z., Krawczynski M. J., **Heck P. R.** and Spear F. S. (2021) Iron, magnesium, and titanium isotopic fractionations between garnet, ilmenite, fayalite, biotite, and tourmaline: results from NRIXS, ab initio, and study of mineral separates from the Moosilauke metapelite. *Geochimica et Cosmochimica Acta* **302**, 18–45.

66. **Heck P. R., Greer J.***, Boesenberg J. S., Bouvier A., Caffee M. W., Cassata W. S., Corrigan C., Davis A. M., Davis D. W., Fries M., Hankey M., Jenniskens P., Schmitt-Kopplin P., Sheu S., Trappitsch R., Velbel M., Weller W., Welten K., Yin Q.-Z., Sanborn M. E.,

Ziegler K., Rowland D., Verosub K., Zhou Q., Liu Y., Tang G., Li Q. , Li X., and Zajacz Z. The Fall, Recovery, Classification and Initial Characterization of the Hamburg, Michigan H4 Chondrite. *Meteoritics & Planetary Science* **55**, 2341–2359 (2020).

65. **Heck P. R.**, **Greer J.**[*], **Kööp L.**[#], Trappitsch R., Gyngard F., Busemann H., Maden C., Ávila JN, Davis A. M., Wieler R. Lifetimes of interstellar dust from cosmic-ray exposure ages of presolar silicon carbide. *PNAS* **117**, 1884–1889 (2020).

64. **Greer J.**[*]**, Rout S. S.**[#], Isheim D., Seidman D. N., Wieler R., & **Heck P. R.** Atom-probe tomography of space weathered lunar ilmenite grain surfaces. *Meteoritics & Planetary Science* 55, 426–440 (2020).

63. Schmitz B., Farley K. A., Goderis S., **Heck P. R.**, Bergström S. M., Boschi S., Claeys P., Debaille V., Dronov A., van Ginneken M., Harper D. A. T., Iqbal F., Friberg J., Liao S., Martin E., Meier M. M. M., Peucker-Ehrenbrink B., Soens B., Wieler R. and Terfelt F. (2019) An extraterrestrial trigger for the mid-Ordovician ice age: Dust from the breakup of the L-chondrite parent body. *Science Advances* **5**, eaax4184.

62. Schmitz B., Feist R., Meier M. M. M., Martin E., **Heck P. R.**, Lenaz D., Topa D., Busemann H., Maden C., Plant A. A. and Terfelt F. The micrometeorite flux to Earth during the Frasnian–Famennian transition reconstructed in the Coumiac GSSP section, France. *Earth and Planetary Science Letters* 522, 234–243 (2019).

61. **Heck P. R.**, Herd C., Grossman J. N., Badjukov D., Bouvier A., Bullock E., Chennaoui-Aoudjehane H., Debaille V., Dunn T. L., Ebel D. S., Ferrière L., Garvie L., Gattacceca J., Gounelle M., Herd R., Ireland T., Jacquet E., Macke R. J., McCoy T., McCubbin F. M., Mikouchi T., Metzler K., Roskosz M., Smith C., Wadhwa M., Welzenbach-Fries L., Yada T., Yamaguchi A., Zeigler R. A. and Zolensky M. Best practices for the use of meteorite names in publications. *Meteoritics & Planetary Science* 54, 1397–1400 (2019).

60. **Kööp L.**[#], **Heck P. R.**, Busemann H., Davis A. M., **Greer J.***, Maden C., Meier M. M. M., Wieler R. High early solar activity inferred from helium and neon excesses in the oldest meteorite inclusions. *Nature Astronomy*, https://doi.org/10.1038/s41550-018-0527-8 (2018).

59. **Heck P. R.,** Jadhav M., Meier M. M. M., Maruoka T., Amari S., Zinner E., Busemann H., Maden C., Gyngard F., Baur H., Wieler R. Neon Isotopes in Individual Presolar Low-Density Graphite Grains from the Orgueil Meteorite. *Meteoritics & Planetary Science*, https://doi.org/10.1111/maps.13129 (2018).

58. Meier M. M. M., Bindi L., **Heck P. R.,** Neander A. I.; Spring N. H., Riebe M. E. I., Maden C., Baur H, Steinhardt P. J., Wieler R., Busemann H. Cosmic history and a candidate parent asteroid for the quasicrystal-bearing meteorite Khatyrka. *Earth and Planetary Science Letters*, https://doi.org/10.1016/j.epsl.2018.03.025 (2018).

57. Walker R. J., Yin Q., **Heck P. R.** Rapid Effects of Terrestrial Alteration on Highly

Siderophile Elements in the Sutter's Mill Meteorite. *Meteoritics & Planetary Science*, https://doi.org/10.1111/maps.13102 (2018).

56. **Rout S. S.#, Heck P. R.,** Schmitz B. Shock history of the fossil ungrouped achondrite Österplana 065: Raman spectroscopy and TEM of relict chrome-spinel grains. *Meteoritics & Planetary Science*, doi: 10.1111/maps.13041 (2018).

55. **Rout S. S.[#], Heck P. R.,** Isheim D., and Seidman D. N. Atom-probe tomography and transmission electron microscopy of the kamacite-taenite interface in the fast cooled Bristol IVA iron meteorite. *Meteoritics & Planetary Science* 52, 2707-2729 (2017).

54. Schmitz B., **Heck P. R.**, Alvarez W., Kita N. T., **Rout S. S.[#]**, Cronholm A., Defouilloy C., Martin E., Smit J., Terfelt F. The meteorite flux to Earth in the Early Cretaceous as reconstructed from sediment-dispersed extraterrestrial spinels. *Geology*, doi:10.1130/G39297.1 (2017).

53. **Kööp L.***, Nakashima D., **Heck P. R.**, Kita N. T., Tenner T. J., Krot A. N., Nagashima K., Park C., Davis A. M. A multielement isotopic study of refractory FUN and F CAIs: Mass-dependent and mass-independent isotope effects. *Geochimica et Cosmochimica Acta*, doi:10.1016/j.gca.2017.04.029 (2017).

52. **Rout S. S.[#]**, **Heck P.R.,** Zaluzec N., Ishii T., Wen J., Miller D., and Schmitz B. Shocked chromites in fossil L chondrites: A Raman spectroscopy and transmission electron microscopy study. *Meteoritics & Planetary Science*, doi:10.1111/maps.12887 (2017).

51. **Heck P. R.**, Schmitz B., Bottke W. F., **Rout S. S.[#]**, Kita N. T., Cronholm A., Defouilloy C., Dronov A. & Terfelt F. Rare meteorites common in the Ordovician period. *Nature Astronomy* **2**, DOI: 10.1038/s41550-016-0035 (2017).

50. Burkhardt C., Dauphas N., Tang H., Fischer-Gödde M., Qin L., Chen J. H., **Rout S. S.[#]**, Pack A., **Heck P. R.**, and Papanastassiou, D. In search for the Earth forming reservoir: Mineralogical, chemical and isotopic characterizations of the ungrouped chondrite NWA 5363/5400 and selected chondrites. *Meteoritics & Planetary Science*, DOI: 10.1111/maps.12834 (2017).

49. Boschi S., Schmitz B., **Heck P. R.**, Cronholm A., Defouilloy C., Kita N. T., Monechi S., Montanari A., **Rout S. S.[#]**, Terfelt F. Late Eocene ^{3}He and Ir anomalies associated with ordinary chondritic spinels. *Geochimica et Cosmochimica Acta* **204**, 205–218 (2017).

48. **Kööp L.***, Davis A. M., Nakashima D., Park C., Krot A. N., Nagashima K., Tenner T. J., **Heck P. R.**, Kita N. T. A link between oxygen, calcium and titanium isotopes in ^{26}Al-depleted hibonite-rich CAIs from Murchison and implications for the heterogeneity of dust reservoirs in the solar nebula. *Geochimica et Cosmochimica Acta* **189**, 70-95 (2016).

47. **Kööp L.***, Nakashima D., **Heck P. R.**, Kita N. T., Tenner T. J., Krot A. N., Nagashima K.,

Park C., Davis A. M. New constraints on the relationship between ^{26}Al and oxygen, calcium, and titanium isotopic variation in the early Solar System from a multielement isotopic study of spinel-hibonite inclusions. *Geochimica et Cosmochimica Acta* **184**, 151–172 (2016).

46. **Heck P. R.,** Schmitz B., **Rout S. S.**[#], Tenner T., **Villalon K.**[*], Cronholm A., Terfelt F., and Kita N. T. A search for H-chondritic chromite grains in sediments that formed immediately after the breakup of the L-chondrite parent body 470 Ma ago. *Geochimica et Cosmochimica Acta* **177**, 120–129 (2016).

45. Schwander D., **Kööp L.***, Berg T., Schönhense G., **Heck P. R.**, Davis A.M., and Ott U. Formation of refractory metal nuggets and their link to the history of CAIs. *Geochimica et Cosmochimica Acta*, **168**, 70–87 (2015).

44. Schmitz B., Boschi S., Cronholm A., **Heck P. R.**, Monechi S., Montanari A., and Terfelt F. Fragments of Late Eocene Earth-impacting asteroids linked to disturbance of asteroid belt. *Earth and Planetary Science Letters*, **425**, 77–83 (2015).

43. Stephan T., **Heck P. R.**, Isheim D., and Lewis J.B. Correction of dead time effects in laser-induced desorption time-of-flight mass spectrometry: Applications in atom probe tomography. *International Journal of Mass Spectrometry*, **379**, 46–51 (2015).

42. Stardust ISPE Consortium: Westphal A. J., [...], **Ansari A.**[*], [...], **Heck P. R.**, [...], **King A. J.**[#] et al. Evidence for interstellar origin of seven dust particles collected by the Stardust spacecraft. *Science*, **345**, 786–791 (2014).

41. Schmitz B., Huss G. R, Meier M. M. M., Peucker-Ehrenbrink B., Church R. P., Cronholm A., Davies M. B., **Heck P. R.**, Johansen A., Keil K., Kristiansson P., Ravizza G., Tassinari M., and Terfelt F. A fossil winonaite-like meteorite in Ordovician limestone: A piece of the impactor that broke up the L-chondrite parent body? *Earth and Planetary Science Letters*, **400**, 145–152 (2014).

40. **Heck P. R.**, Stadermann F. J., Isheim D., Auciello O., Daulton T. L., Davis A. M., Elam J. E., Floss C., Hiller J., Larson D. J., Lewis J. B., Mane A., Pellin M. J., Savina M. R., Seidman D. N., and Stephan T. Atom-Probe Analyses of Nanodiamonds from Allende. *Meteoritics & Planetary Science*, **49**, 453–467 (2014).

39. Stardust ISPE Consortium: Westphal A. J., [...], **Ansari A.**[*], [...], **Heck P. R.**, [...], **King A. J.**[#] et al. Stardust Interstellar Preliminary Examination I: Identification of tracks in aerogel. *Meteoritics & Planetary Science* **49**, 1509–1521 (2014).

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S. F., **Heck, P. R.**, Horányi, M., Hoppe P., Hörz, F. P., Huth, J., Kearsley, A. Leroux, H., Marhas, K., Nakamura-Messenger, K., Sandford, S. A., See, T. H., Stadermann, F. J., Teslich, N. E., Tsitrin, S., Warren, J. L., Wozniakiewicz, P. J., Zolensky, M. E. Non-Random Spatial Distribution of Impacts in the Stardust Cometary Collector. *Lunar Planet. Institute*, #1418, CD-ROM (2007).

13. **Heck, P. R.**, Schmitz, B., Baur, H. & Wieler, R. Solar Noble Gases in 470 Myr Old Fossil Micrometeorites. *Meteoritics & Planetary Science* **41**, Supplement, abstract #5055 (2006).

12. **Heck, P. R.**, Hoppe, P., Gröner, E., Marhas, K. K., Baur, H. & Wieler, R. Rare Presolar Silicon Carbide Grains from Novae: An Automated Search by NanoSIMS. *Meteoritics & Planetary Science* **41**, Supplement, abstract #5054 (2006).

11. **Heck, P. R.**, Hoppe, P., Gröner, E., Marhas, K. K., Baur, H. & Wieler, R. Automated search for rare presolar silicon carbide from novae and of Type A/B: A combined isotopic study of single grains with NanoSIMS and noble gas mass spectrometry. *Lunar Planet. Institute*, #1335, CD-ROM (2006).

10. Hoppe P., **Heck P.**, Hörz F., Huth J., Marhas K. K., Messenger K., Snead C., & Westphal A. NanoSIMS studies of dust projectile shots into Stardust-type aerogel and aluminum foils. *Lunar Planet. Institute*, #1546, CD-ROM (2006).

9. The Stardust Cratering Team: Hörz F., Borg J., Bradley J. P., Brownlee D. E., Burchell M. J., Cole M. J., Dai Z. R., Djouadi Z., Floss C., Franchi I., Graham G. A., Green S. F., **Heck P.**, Hoppe P., Kearsley A. T., Leitner J., Leroux H., Teslich N., Marhas K. K., Schwandt C. C., See T. H., Stadermann F. J., Stephan T., Troadec D., Tsou P. & Zolensky M. Microcraters in aluminum foils exposed by Stardust. *Lunar Planet. Institute*, #1148, CD-ROM (2006).

8. **Heck, P. R.**, Marhas, K. K., Baur, H., Hoppe, P. & Wieler, R. Presolar He and Ne in Single Circumstellar SiC Grains Extracted from the Murchison and Murray Meteorites. *Lunar Planet. Institute*, #1938, CD-ROM (2005).

7. **Heck, P. R.**, Schmitz, B., Baur, H. & Wieler, R. Determination of Production Rates of Cosmogenic He and Ne in Meteoritic Chromite Grains. *Lunar Planet. Institute*, #1712, CD-ROM (2005).

6. **Heck, P. R.**, Baur, H., Schmitz, B. & Wieler, R. Very Short Delivery Times of Meteorites After the L-Chondrite Parent Body Break-Up 480 Myr Ago. *Lunar Planet. Institute*, #1492, CD-ROM (2004).

5. **Heck, P. R.**, Baur, H., Schmitz, B. & Wieler, R. Cosmic-ray exposure ages of 480 Ma old fossil meteorites: The L-chondrite parent-body break-up event? *Geochim. Cosmochim. Acta* **67** (18), A143-A143 Suppl. 1 (2003).

4. **Heck, P. R.**, Baur, H., Schmitz, B. & Wieler, R. Evidence for the L-Chondrite Parent Body Breakup Event? Cosmic-Ray Exposure Ages of 480 Myr Old Fossil Meteorites. *Meteoritics & Planetary Science* **38**, Supplement, abstract #5074 (2003).

3. **Heck, P. R.**, Baur, H., Schmitz, B. & Wieler, R. Cosmic-ray exposure age of a 480 Myr old fossil meteorite by noble gas analayses of relict chromite grains. *Lunar Planet. Institute*, #1751, CD-ROM, (2003).

2. **Heck, P.R.**, Anselmetti, F.S., Isern, A.R., & Stone, D. Current-controlled carbonate sedimentation on a modern platform slope: variations in sediment composition diagenetic alterations and physical properties at planned ODP Leg 194 drill sites (Marion Plateau). *EOS Trans. AGU*, Fall Meet. Suppl., **80**: F525 (1999).

1. Isern, A. R., Anselmetti, F., **Heck, P. R.**, Pigram, C. J., Stone, D. ODP Leg 194: Oligocene to Pliocene Sea Level Variations and Carbonate Platform Development in a Mixed Carbonate-Siliciclastic System on the Marion Plateau, NE Australia, *EOS Trans. AGU*, Fall Meet. Suppl., **80**: F. (1999)

INVITED TALKS AT SCIENTIFIC INSTITUTIONS AND CONFERENCES

35. Seminar talk, **American Museum of Natural History**, New York, NY, February 2021 (online).

34. Seminar talk, **Portland State University,** Portland, OR, November 2020 (online).

33. Seminar talk, **Lunar and Planetary Institute**, Houston, TX, July 2020 (online).

32. Seminar talk (public), **University of Melbourne**, Melbourne, Australia, September 2019.

31. Seminar talk, **Earth Life Science Institute, Tokyo Institute of Technology**, Tokyo, Japan, July 2019.

30. Seminar talk, Dept. of Earth, Atmospheric, and Planetary Sciences, **Purdue University**, West Lafayette, IN, May 2019.

29. **Microscopy & Microanalysis 2017 Meeting,** Symposium P10.3: 75the Anniversary Session: Diamonds: From the Origins of the Universe to Quantum Sensing in Materials and Biological Science Applications, St. Louis, MO: "The Enigmatic Origin of Meteoritic Nanodiamonds – An Approach with Atom-Probe Tomography."

28. Seminar talk, **Department of Terrestrial Magnetism, Carnegie Institution for Science**, Washington DC, May 2017.

27. **Microscopy & Microanalysis 2016 Meeting,** Symposium P09: From Angstrom to AU: Studies of Planet-Forming Materials, Columbus, OH: "Microanalysis of Fossil

Micrometeorites and Meteorites to Study A Major Asteroid Collision ~470 Million Years Ago."

26. **Keynote lecture, Experimental Cosmochemistry Workshop**, Yokohama, Japan, June 2016, "Atom-Probe Tomography of Extraterrestrial Samples".

25. Seminar talk, Department of Geological Sciences, **Michigan State University**, October 2, 2015, "A Catastrophic Asteroid Breakup Recorded in Terrestrial Sediments".

24. Seminar talk, Department of Physics and Astronomy, **Michigan State University**, October 1, 2015, "Presolar Stardust – the Oldest Solid Samples in the Lab".

23. **Microscopy & Microanalysis 2014 Meeting,** Symposium P3: Mineral Analyses from Laboratory to Spacecraft, Hartford, CT, August 2014, "Atom Probe Analyses of Nanodiamonds".

22. Seminar talk, Department of the Geophysical Sciences, **The University of Chicago**, Chicago, IL, April 2014.

21. Seminar talk, Department of Materials Science and Engineering, **Northwestern University**, Evanston, IL, February 2014.

20. Inauguration of the Centre for Advanced Surface Analysis, **University of Lausanne** and **École Polytéchnique Fédérale de Lausanne (EPFL)**, Switzerland, June 2013. "Evidence on Earth of a major cosmic collision: oxygen and neon isotopes of an impact crater and fossil meteorites".

19. Colloquium, Department of Physics, **Washington University in St. Louis**, February 2013. "Cosmic Collisions and Their Significance Revealed by Laboratory Analysis of Extraterrestrial Matter".

18. 31st & 32nd Indian Scientific Expeditions to Antarctica, Indian Antarctic Station Maitri, **National Centre for Antarctic & Ocean Research**, December 2012. "Meteorites, their Origins and Antarctica".

17. **Argonne National Laboratory** 2012 Users Meeting, May 2012. "Laboratory Analysis of Extraterrestrial Dust".

16. Seminar talk at Department of Geography-Geology, **Illinois State University**, Normal, IL, April 2012. "Fossil Meteorites: Traces of Cosmic Collisions".

15. Seminar talk at Department of Earth and Space Sciences, **UCLA**, October 2011. "Atom-Probe Tomography of Meteoritic and Synthetic Nanodiamonds".

14. Nuclear, Particle and Astrophysics Seminar, Department of Physics, **University of Basel, Switzerland**, April 2011. "Presolar Grains from Meteorites - Laboratory Analysis of Bona Fide Stardust".

13. Seminar, Department of Earth and Environmental Sciences, **University of Illinois at Chicago**, March 2011. "Fossil Meteorites and Micrometeorites in Marine Sediments: Preserved Traces of Solar System Events".

12. Astrophysics Luncheon, Physics Division, **Argonne National Laboratory**, Argonne (USA), December 2010. "Experimental Interstellar Residence Times of Presolar Dust Grains from Meteorites".

11. Careers in Chemistry Symposium, Department of Chemistry, **University of Illinois at Urbana-Champaign**, July 2010. "Museum Curator – An Unconventional Career in Chemistry".

10. Adler Research Division Colloquium, **Adler Planetarium**, Chicago (USA), July 2010. "Presolar Grains – Solid Samples of Stars in the Laboratory".

9. Calibrating Geological Records of Environmental Change from Lakes to Oceans, **Monte Verità Research Conference**, Ascona (Switzerland), July 2009. "Silicon and oxygen isotope geochemistry of Archean and Paleoproterozoic banded iron formations (Isua, Transvaal, Hamersley, Biwabik)".

8. Department of Geology, **The Field Museum**, Chicago (USA), June 2009.
"A Major Asteroid Collision Recorded in Earth's Sediments: Fossil Meteorites and Micrometeorites Recovered from a 470-Million-Year-Old Seabed".

7. Chicago Center for Cosmochemistry, **University of Chicago** (USA), October 2008.
"Interstellar Residence Times of Presolar Jumbo SiC from Murchison and Noble Gas Analyses of Ordovician Extraterrestrial Chromite Grains".

6. Two invited talks at the **Goldschmidt Conference**, Vancouver (Canada), July 2008.
1) Session 20e: Coordinated imaging and high resolution in-situ analyses at the micron scale; 2) Session 01a: Isotopic anomalies *(invitations declined due to laboratory duties).*

5. Department of General Physics, **University of Turin** (Italy), November 2005.
"Helium and Neon in Presolar Silicon Carbide Grains and Relict Chromite Grains from Fossil Meteorites as Tracers of their Origin".

4. Max-Planck-Institute for Chemistry, Mainz (Germany), July 2005. "Presolar He and Ne in single SiC grains from Murchison and Murray Meteorites".

3. Institute of Physics, **University of Bern** (Switzerland), May 2005. "Helium and Neon in Presolar Silicon Carbide Grains and Relict Chromite Grains from Fossil Meteorites as

Tracers of their Origin".

2. Laboratory for Space Sciences, **Washington University, St. Louis** (USA), March 2005. "Noble Gases in Single Presolar Silicon Carbide Grains".

1. Physical Research Laboratory, Ahmedabad (India), November 2003. "The L chondrite parent body breakup: New evidence from cosmic-ray exposure ages of fossil meteorites".