

Curriculum Vitae, Denton S. Ebel

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DEGREES

Ph.D. Purdue University	Geology, December, 1993
M.S. Purdue University, W. Lafayette, IN	Geology, August 1988
B.A. Harvard College, Cambridge, MA	Sociology, June 1982

ACADEMIC APPOINTMENTS

2015-present	Adjunct Professor, <u>Dept. Earth & Environmental Sci.</u> , Columbia U.
2015-present	Faculty, <u>Master of Arts in Teaching</u> , RGGGS
2012-present	Chair, <u>Division of Physical Sciences</u> , AMNH.
2011-present	Curator, <u>American Museum of Natural History</u> , NY.
2011-present	Professor, <u>Richard Gilder Graduate School (RGGGS)</u> , AMNH.
2007-present	Curator-in-Charge, <u>Dept. of Earth and Planetary Sciences</u> , AMNH.
2009-present	Adjunct Graduate Faculty, CUNY Graduate School and University Center, <u>Ph.D. Program in Earth & Environmental Sciences</u> .
2005-present	Director, <u>OFM Research</u>
2007-2011	Associate Professor, Richard Gilder Graduate School (RGGGS), AMNH.
2006-2011	Associate Curator with tenure, AMNH.
2002-2015	Adjunct Associate Research Scientist, <u>Lamont-Doherty Earth Observatory of Columbia University</u> , New York.
2001-2006	Assistant Curator, Meteorites, American Museum of Natural History, NY.
1999-2001	Research Scientist, <u>University of Chicago</u> , Chicago, Illinois.
1995-1999	Research Associate, University of Chicago, with L. Grossman.
1993-1995	Post Doctoral Fellow, <u>University of Toronto</u> , with A.J. Naldrett.
1985-87; 90-93	Teaching fellow in mineralogy and petrology, <u>EAPS</u> , Purdue University.
1982	Geological field assistant, Sierra Nevada.

PUBLICATIONS (in preparation)

- (2018) **Visible-near-infrared reflectance spectroscopy of ordinary chondrite meteorites under simulated asteroid surface conditions.** Gemma, M. E., K. A. Shirley, T. D. Glotch and D. S. Ebel. For submission to a special issue of *Journal of Geophysical Research - Planets*.
- (2018) **Astrophysical implications of meteoritical complementarity.** Hubbard, A., M-M. Mac Low and D. S. Ebel. For submission to *Astrophysical Journal*.
- (2018) **Dust concentration and chondrule formation.** Hubbard, A., M-M. Mac Low and D. S. Ebel. For submission to *Astrophysical Journal*.

PUBLICATIONS (peer reviewed, accepted)

- (2018) **The elusive origin of Mercury.** Ebel, D. S. and S. T. Stewart. In *Mercury: The View after MESSENGER*. Eds. S. C. Solomon, B. J. Anderson and L. R. Nittler. *Cambridge U. Press*. (in press).

- (2018) **Vapor-melt exchange - Constraints on chondrule formation conditions and processes.** Ebel, D. S., C. M. O'D. Alexander and G. Libourel. In *Chondrules*. Eds. S. Russell, A. Krot and H. C. Connolly Jr. *Cambridge U. Press*. (in press).
- (2018) **Evaluating non-shock, non-collisional models for chondrule formation.** Hubbard, A. and D. S. Ebel. In *Chondrules*. Eds. S. Russell, A. Krot and H. C. Connolly Jr. *Cambridge U. Press*. (in press)
- (2017) **Petrogenesis of Miller Range 07273, a new type of anomalous melt breccia: Implications for impact effects on the H chondrite asteroid.** Ruzicka, A. M., M. Hutson, J. M. Friedrich, M.L. Rivers, M. K. Weisberg, D. S. Ebel, K. Ziegler, D. Rumble III, and A. A. Dolan. *Meteoritics and Planetary Science* **52**: 1963-1990.
- (2017) **Relationships among physical properties as indicators of high temperature deformation or post-shock thermal annealing in ordinary chondrites.** Friedrich, J. M., A. Ruzicka, R. J. Macke, J. O. Thostenson, R. A. Rudolph, M. L. Rivers and D. S. Ebel. *Geochimica et Cosmochimica Acta* **203**: 157-174.
- (2016) **The motion of chondrules and other particles in a protoplanetary disc with temperature fluctuations.** Loesche, C., G. Wurm, T. Kelling, J. Teiser, and D.S. Ebel. *Monthly Notices of the Royal Astronomical Society* **463**: 4167-4174.
- (2016) **Microchondrules in three unequilibrated ordinary chondrites**
Bigolski J. N., M. K. Weisberg, H. C. Connolly Jr., and D. S. Ebel.
Meteoritics and Planetary Science, **51**: 235-260.
- (2016) **X-ray computed tomography imaging: A not-so-nondestructive technique**
Sears D. W. G., H. Sears, D. S. Ebel, S. Wallace and J. M. Friedrich.
Meteoritics and Planetary Science, **51**: 833-838.
- (2016) **Abundance, composition and size of inclusions and matrix in CV and CO chondrites.** Ebel, D. S., C. Brunner, K. Leftwich, I. Erb, M. Lu, K. Konrad, H. Rodriguez, J. M. Friedrich and M. K. Weisberg. *Geochimica et Cosmochimica Acta*, **172**: 322-356.
doi: 10.1016/j.gca.2015.10.007 Extended supplement: <http://dx.doi.org/10.5531/sd.eps.2>
- (2015) **Chlorine on the surface of Mercury: Implications for Mercury's surface evolution.** Evans, L. G., P. N. Peplowski, D. S. Ebel, D. J. Lawrence, T. J. McCoy, L. R. Nittler, R. D. Starr, S. Z. Weider, and S. C. Solomon. *Icarus* **257**:417-427.
- (2015) **Evidence for geochemical terranes on Mercury: Global mapping of major elements with MESSENGER's x-ray spectrometer.** Weider, S. Z., L. R. Nittler, R. D. Starr, E. J. Crapster-Pregont, P. N. Peplowski, B. W. Denevi, J. W. Head, P. K. Byrne, S. A. Hauck II, D. S. Ebel, and S. C. Solomon. *Earth and Planetary Science Letters* **416**: 109-120.
- (2015) **Semarkona: Lessons for chondrule and chondrite formation**
Hubbard A. and D. S. Ebel. *Icarus* **245**: 32-37. DOI: 10.1016/j.icarus.2014.09.025
- (2015) **Late formation of a comet Wild 2 crystalline silicate particle, Pyxie, inferred from Al-Mg chronology of plagioclase.** Nakashima, D., T. Ushikubo, N. T. Kita, M. K. Weisberg, M. E. Zolensky, and D. S. Ebel. *Earth and Planetary Science Letters* **410**: 54-61. DOI: 10.1016/j.epsl.2014.11.020
- (2015) **Petrology and geochemistry of chondrules and metal in NWA 5492 and GRO 95551: A new type of metal-rich chondrite.** Weisberg, M. K., D. S. Ebel, D. Nakashima, N. T. Kita, and M. Humayun. *Geochimica et Cosmochimica Acta*, **167**: 269-285.

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- (2012) **Thermochemical stability of low-iron, manganese-enriched olivine in astrophysical environments.** Ebel, D.S., M. K. Weisberg and J. R. Beckett. *Meteoritics and Planetary Science* **47**: 585-593.
- (2012) **Petrology and oxygen isotopes of NWA 5492, a new metal-rich chondrite.** Weisberg, M. K., T. E. Bunch, J. H. Wittke, D. Rumble III, and D. S. Ebel. *Meteoritics and Planetary Science* **47**: 363-373.
- (2011) **Petrology and oxygen isotopic compositions of chondrules in E3 chondrites.** Weisberg, M. K., D. S. Ebel, H. C. Connolly Jr., N. Kita and T. Ushikubo *Geochimica et Cosmochimica Acta* **75**: 6556-6569.
- (2011) **Radioactive elements on Mercury's surface from MESSENGER: Implications for the planet's formation and evolution.** Peplowski, P. N., L. G. Evans, S. A. Hauck II, T. J. McCoy, W.V. Boynton, J. Gillis-Davis, D. S. Ebel, J. O. Goldsten, D. K. Hamara, D. J. Lawrence, R. L. McNutt Jr., L. R. Nittler, S. C. Solomon, E. A. Rhodes, A.L. Sprague, R. D. Starr, and K. R. Stockstill-Cahill. *Science* **333**: 1850-1852.
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S.B. Simon, K.D. McKeegan, D.S. Ebel, and L. Grossman. *Meteor. Planet. Sci.*, **35**: 215-227.
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EXTENDED ABSTRACTS

- (two pages; find at, e.g., <http://www.hou.usra.edu/meetings/lpsc20xx/pdf/abs#.pdf> for 2014 and after, and 2000-2013 at <http://www.lpi.usra.edu/meetings/lpsc20xx/pdf/abs#.pdf>)
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- (2007) **Paleomagnetic evidence for localized chondrule formation and rapid parent body accretion in the protoplanetary disk.** Ebel, D.S. *Meteoritics Planet. Sci Suppl.* **42**: A38 (Abs. #5326).
- (2007) **Petrology of matrix in the Semarkona ordinary chondrite.** Weisberg M.K., D.S. Ebel and H.C. Connolly Jr. *Meteoritics Planet. Sci Suppl.* **42**: A162 (Abs. #5288).
- (2007) **Quantitative petrography of L chondrites: 3D morphologic variations with degree of equilibration and shock loading.** Friedrich J.M., M.L. Rivers, C.E. Nehru, and D.S. Ebel *Meteoritics Planet. Sci Suppl.* **42**: A51 (Abs. #5271).
- (2007) **Did chondrules form in the nebula?** Alexander C.M.O'D., J.N. Grossman and D.S. Ebel. *Meteoritics Planet. Sci Suppl.* **42**: A12 (Abs. #5134).
- (2007) **^{182}Hf - ^{182}W chronometry of CAIs and the age of the solar system.** Burkhardt C., T. Kleine, H. Palme, B. Bourdon, J. Zipfel, J. Friedrich and D. Ebel. *Meteoritics Planet. Sci Suppl.* **42**: A27 (Abs. #5189).
- (2006) **Stardust (Comet 81P/Wild-2) Samples and early solar system processes.** Ebel, D.S. M.K. Weisberg, H.C. Connolly Jr., M. Zolensky, and the Stardust Mineralogy/Petrology Preliminary Examination Subteam. Division of Planetary Sciences of the American Astronomical Society, 2006 meeting, Abstract #888.
- (2006) **Meteorite research collaboration, curation, and education in New York City.** Ebel, D.S. and J.S. Boesenberg. *Meteoritics Planet. Sci Suppl.* **41**: A204 (Abs. #9028, 1st Desert Meteorite Workshop, Morocco).
- (2006) **Layered chondrules in carbonaceous and ordinary chondrites.** Ebel, D.S. and M.K. Weisberg *Meteoritics Planet. Sci Suppl.* **41**: A48 (Abs. #5352).
- (2006) **Variations in lunar opaque phase and grain size: Implications for remote sensing of TiO_2 .** Riner, M. A., M. S. Robinson, P. G. Lucey, and D. S. Ebel. *Meteoritics Planet. Sci Suppl.* **41**: A149 (Abs. #5339).
- (2006) **Sulfide-metal nodules in EH3 chondrites.** Weisberg, M.K., H.C. Connolly, D.S. Ebel, and M. Kimura. *Meteoritics Planet. Sci Suppl.* **41**: A186 (Abs. #5317).
- (2006) **Layered matrix in the CV3 NWA 2364 chondrite.** Friedrich, J.M., M.K. Weisberg, D.S. Ebel, and K.P. Jochum. *Meteoritics Planet. Sci Suppl.* **41**: A57 (Abs. #5298).
- (2006) **Synchrotron X-ray microtomography of extraterrestrial samples.** Ebel, D.S. and M.L. Rivers American Geophysical Union spring 2006 meeting (invited).
- (2006) **High spatial resolution 3D local lambda-tomography of particle tracks and fragmentation in whole aerogel tiles.** Ebel, D.S. and M.L. Rivers. August meeting of SPIE, The International Society for Optical Engineering.
- (2006) **Mineralogy and petrology of comet Wild 2 nucleus samples - final results of the preliminary examination team.** Zolensky et al. (45 authors). *Meteor. Planet. Sci Suppl.* **41**. (Abs. #5344).

- (2005) **High spatial resolution 3D local tomography of particle tracks and fragmentation in aerogel.** Ebel, D.S. and M.L. Rivers *Meteor. Planet. Sci. Suppl.* **40**: A42 (Abs. #5299).
- (2005) **Elemental signatures of nebular and alteration processes in CV, CO, and CR CAIs.** Friedrich, J.M., K.P. Jochum, and D.S. Ebel. *Meteor. Planet. Sci. Suppl.* **40**: A51 (Abs. #5112).
- (2005) **Fountain Hills impact melted CB chondrite and thermal history of the CB parent body.** Weisberg, M.K. and D.S. Ebel (Abstract 5228) *Meteor. Planet. Sci. Suppl.* **40**: A167.
- (2005) **A 3-d tomographic survey of compound chondrules in CR chondrites.** Hylton, S.N., D.S. Ebel, and M.K. Weisberg. *Meteor. Planet. Sci. Suppl.* **40**: A71 (Abs. #5305).
- (2005) **Heterogeneous Th-U-Pb isotope and elemental systematics in calcium-aluminum-rich inclusions determined by LA-ICPMS.** Jochum, K.P., J.M. Friedrich, D.S. Ebel, and S.J.G. Galer. *Meteor. Planet. Sci. Suppl.* **40**: A76 (Abs. #5108).
- (2005) **Ti, Al-Rich Ca-pyroxene assemblages in CAIs.** Nehru, C.M., M.K. Weisberg, and D.S. Ebel *Meteor. Planet. Sci. Suppl.* **40**: A111 (Abs. #5296)..
- (2005) **Refractory trace elements in the solar system's first condensates: Analysis and implications of Zr/Hf and Nb/Ta in CAIs.** Friedrich, J.M., D.S. Ebel, and K.P. Jochum. *230th Annual Meeting of the American Chemical Society* (Abs. #895089).
- (2004) **3D tomographic measurements on Allende volumes - Constraints on the formation and accretion of chondrules and matrix.** Ebel, D.S., T.W. Schoenbeck, and H. Palme. *Meteoritics Planet. Sci. Suppl.* **39**: A33 (Abs. #5153).
- (2004) **3D-microtomographic determination of chondrule/matrix ratios in carbonaceous chondrites.** Schoenbeck, T.W. and D.S. Ebel. *Geochim. Cosmochim. Acta Suppl.*, **68**: A765.
- (2002) **Origin of enstatite chondrites and implications for the inner planets.** Ebel, D.S. and C.M.O'D. Alexander *12th Ann. Goldschmidt Conf.* (invited), *Geochimica et Cosmochimica Acta Suppl.*, **66**: A205 (Abs. #2335).
- (2002) **Model evaporation of FeO-bearing liquids.** Ebel, D.S. *Meteoritics Planet. Sci. Suppl.* **37**: A43 (Abs. #5269).
- (2002) **Petrologic-tomographic study of metal in the CR chondrites.** Weisberg, M.K., D.S. Ebel, H.C. Connolly, Jr., J.S. Boesenberg, and D. Castellano. *Meteoritics Planet. Sci. Suppl.* **37**: A149 (Abs. #5254).
- (2001) **Vapor/liquid/solid equilibria when chondrites collide.** Ebel, D.S. *Meteoritics Planet. Sci. Suppl.* **36**: A52-A53 (Abs. #5427).
- (2001) **Condensation from the plume of an oblique Chicxulub impact.** Ebel, D.S., and L. Grossman. *Meteoritics Planet. Sci. Suppl.* **36**: A53 (Abs. #5404).
- (2001) **Melilite: A petrogenetic indicator in refractory inclusions.** Ebel, D.S., and L. Grossman. In *Eleventh Annual V.M. Goldschmidt Conference*, Abstract #3299. LPI Contribution No. 1088, Lunar Planet. Institute, Houston (CD-ROM). (Invited)
- (2000) **Melilite zoning during partial evaporation of calcium-aluminum-rich inclusion droplets.** Ebel, D.S., L. Grossman. *Meteoritics Planet. Sci. Suppl.* **35**: A49-50 (Abs. #5254).
- (1998) **Rhodium and palladium partitioning between copper-nickel-pyrrhotite and sulfide liquid.** Ebel, D. S., and A. J. Campbell. *Geol. Soc. Am. Abstracts with Program*, **30A**: 318.

- (1998) **Condensation from cosmic gas made of free atoms.**
Ebel, D.S. and L. Grossman. *Meteoritics Planet. Sci Suppl.* **33**: A43-44.
- (1997) **Effects of pressure and dust enrichment on silicate-liquid stability.**
Ebel, D.S. and L. Grossman. *Meteoritics Planet. Sci Suppl.* **32**: A37.
- (1996) **Limiting conditions for silicate liquid stability in cosmic gases.**
Ebel, D.S. and L. Grossman. *Meteoritics Planet. Sci Suppl.*, **31**: A40-A41.
- (1996) **Fractional crystallization of sulfide melts.**
Naldrett, A.J. and D.S. Ebel. In *Sixth international symposium on experimental mineralogy, petrology and geochemistry, Terra Abstracts* **8**: 47.
- (1994) **Experimental Ni-pyrrhotite and (Fe, Ni, S)-liquid equilibria above 1000°C.**
Ebel, D.S. and A.J. Naldrett. *American Geophysical Union, EOS* **75**: 719-720.
- (1993) **Experimental determination of the free energy of formation of freibergite fahlore.**
Ebel, D.S. and R.O. Sack. *Geological Society of America Abstracts with Program*, **25A**: 96.
- (1991) **Ore reserve estimation from tetrahedrite composition.**
Ebel, D.S. and R.O. Sack. *Geological Society of America Abs. with Program*, **23A**: 417.
- (1988) **Ag-Cu and Sb-As exchange energies in (Ag,Cu)₁₀(Fe,Zn)₂(As,Sb)₂S₁₃ sulfosalts.**
Ebel, D.S. and R.O. Sack. *EOS* **69**: 528.

OTHER PUBLICATIONS

- (2013) Review of book, **Practical Chemical Thermodynamics, for Geoscientists**, by B. Fegley, Jr.
Ebel, D.S. *Meteoritics and Planetary Science* **48**: 712-713.
- (2007) Review of book, **Planet Formation**, ed. by H. Klahr and W. Brandner
Ebel, D.S. *Meteoritics and Planetary Science* **42**: 467-468.
- (2006) **History of the American Museum of Natural History meteorite collection**
Ebel, D.S. In: McCall G.J.H., Bowden A.J., and Howarth R.J. (eds) *The History of Meteoritics and Key Meteorite Collections: Fireballs, Falls and Finds*. Geological Society, London, Special Publications **256**: 267-289 (peer reviewed).
- (2006) **Stunt double.** Ebel, D.S. *Natural History*, February 2006, p. 64 (endpaper)
(how AMNH meteorite was used to test Rover tool, aiding decision not to grind meteorite on Mars)
- (2004) **New Arthur Ross Hall of Meteorites at the American Museum of Natural History**
Ebel, D.S. and J.S. Boesenberg. *Meteoritics and Planetary Science* **39**: 1761-1762.
- (1998) **Meteorite.**
Ebel, D.S. In *McGraw-Hill Encyclopedia of Science and Technology Yearbook*, p. 247-249.

MULTIMEDIA and ON-LINE AUTHORSHIP

- (2008) On-line course 'The Solar System', offered by AMNH Seminars in Science. Co-author with Dr. Neil D. Tyson. (<http://www.amnh.org/learn/courses/solarsystem.php>)

GRANTS (P.I. or Co-I.)

- 2016 Principal Investigator, NASA Emerging Worlds program (# NNX16AI32G)
"Non-destructive Analysis of Comet Grains and Tracks: Minerals and Original

- grain Properties” (3 yr.)
- 2016 Principal Investigator, NASA Emerging Worlds program (# NNX16AD37G)
“Chemistry and Architecture of Meteorites: Constraints on Astrophysical Models and Ground Truth for Exploration” (3 yr.)
- 2015 Co-Investigator, NASA SMD Science Education CAN
“OpenSpace: An Engine for Dynamic Visualization of Earth and Space Science for Informal Education and Beyond” (5 yr.)
- 2014 Principal Investigator, NASA Lab Analysis of Returned Samples, equipment grant
“Support for a Raman Spectrometer for Laser Scanning Confocal Microscopy of Stardust Samples” (1 yr.)
- 2012 Co-Investigator, NSF EarthScope education and outreach grant
“Collaborative Research: Immersive audio-visualization of seismic wave fields in the Earth” (with Columbia and Princeton, 1 yr.)
- 2012 Co-Principal Investigator, NYSTAR grant
“Innovation Economy Matching Grant: High Resolution CT Scanner (1 yr.)
- 2012 Principal Investigator, NASA Cosmochemistry, equipment grant
“Support for an Electron Backscatter Diffraction Instrument for Scanning Electron Microscopy of Meteorite and Comet Samples” (1 yr.)
- 2010 Principal Investigator, NASA Cosmochemistry program (# NNX10AI42G)
“Thermochemical Histories of the Earliest Solar System Solids” (4 yrs).
- 2010 Co-Principal Investigator, NSF MRI-R2 equipment grant.
“Acquisition of a High Resolution CT-Scanner at the American Museum of Natural History” (3 yrs)
- 2010 Principal Investigator, NASA LARS equipment grant (#NNX10AH06G)
“Partial Support for Upgrading a Laser Confocal Scanning Microscope for Non-destructive High-resolution 3D Imaging of Comet Sample Tracks in Aerogel Returned by the Stardust Mission” (1 yr).
- 2008 Principal Investigator, NASA Cosmochemistry Program (# NNX09AE84G)
“Thermochemical and Petrological Exploration of the Earliest Solar System Solids” (1 yr)
- 2008 Principal Investigator, NASA SRLIDAP grant NNX09AC31G, (3 yrs).
“Laser Confocal Microscopy and X-ray Fluorescence Analysis of Grains in Aerogel”
- 2008 Co-Principal Investigator, NSF Cyber-Enabled Discovery Initiative (Type I)
“Combined Global Physical, Chemical, and Mineralogical Models of Protoplanetary Disks” PI: M-M. Mac Low, AMNH. (3 yrs)
- 2007 Co-Investigator, NASA Planetary Geology and Geophysics Program.
“Planetary Impact Ejecta and the Physico-Chemical Evolution of Expansion Plumes: A Multidisciplinary Approach” PI: N. Artemieva, Planetary Science Institute., Tucson. (3 yrs)
- 2007 Co-Investigator, NASA Laboratory Astrophysics Program.
“Far-infrared Spectroscopy of Mineral Particles”
PI: R.E. Peale, U. Central Florida. (3 yrs)

- 2006 Principal Investigator, NASA SRLIDAP grant NNG06GE42G.
“Synchrotron X-ray Tomographic 3-dimensional Location of Particles and Tracks in Whole Aerogel Tiles” (2 yrs)
- 2006 Principal Investigator, NASA Cosmochemistry grant NANG06GD89G.
“Thermochemistry and Petrology of Early Solar System Materials” (3 yrs)
- 2003 Team Lead, NASA Institutional Education/Public Outreach supplement to grant NAG5-12855, “Outreach for Opening a New Hall of Meteorites and Planetary Science at the American Museum of Natural History: Online Guide, Open House, Teachers Institute”
- 2003 Principal Investigator, NASA Cosmochemistry grant NAG5-12855
“Thermochemistry and Petrology of Early Solar System Materials”
- 2001-2012 Principal Investigator, over 20 successful Advanced Photon Source synchrotron beamtime proposals for x-ray computer-assisted microtomography (XR-CMT) and x-ray fluorescence analysis (XRF).
- 1998-2001 Co-Investigator, NASA Cosmochemistry grant NAG5-4476
(PI: L. Grossman, U. Chicago)

GRANTS (External, subcontracts)

- 2017 P.I. Daniel Savin (Columbia), NASA Solar System Workings
“The impact of solar wind ions on the Surface and exosphere of Mercury” (3 yr.)
- 2015 P.I. Steven Desch (ASU), NASA Nexus for Exoplanet System Science (NExSS)
“Exoplanetary ecosystems: Exploring life’s detectability on chemically diverse exoplanets” (5 yrs)

AWARDS

- 2014 Elected Fellow, Mineralogical Society of America
- 2010 Elected Fellow, The Meteoritical Society
- 1992 Outstanding Graduate Student Award, Dept. of Earth and Atmospheric Sciences, Purdue
- 1988-1990 David Ross Graduate Fellowship, Purdue University Research Foundation
- 1982 Dedicated and Faithful Service Award, Dudley House, Harvard College

MEMBERSHIPS

- Microanalysis Society (MAS), since 2013
- European Association of Geochemistry (EAG), since 2011
- Division of Planetary Sciences (DPS), American Astronomical Society (AAS), since 2006
- Amateur Astronomers Association of New York, since 2002
- National Space Society (NSS), since 2001
- The Planetary Society, since 2001
- New York Academy of Sciences (NYAS), since 2001
- The Meteoritical Society, since 1998 (elected **fellow**, 2010)
- The Geochemical Society, since 1992
- American Geophysical Union (AGU), since 1987

Geological Society of America (GSA), since 1986
 Mineralogical Society of America (MSA), since 1985 (elected **fellow**, 2014)
 American Association for the Advancement of Science (AAAS), since 1985

INVITED SCIENTIFIC PRESENTATIONS (selected)

- 9 June 2017 *The Complementary Nature of Chondrite Components*
 “theme-inar”, Observatoire de la Côte d’Azur, France.
- 24 May 2017 *Mercury’s Enigmatic Origin: Results from the MESSENGER Mission*
 Colloquium, Institute de Physique du Globe de Paris.
- 9 Mar 2016 *New Jersey! A Habitable Place During an Asteroid Strike ...*
 Colloquium, Dept. of Earth & Planetary Sci., Rutgers University.
- 31 Oct 2014 *Constraints on Astrophysical Disk Models from Chondritic Meteorites.*
 Colloquium, Dept. of Earth & Planetary Sci., U. New Mexico.
- June 2014 *Hierarchical Accretion, Melting by Short Circuits, and the Origin of Chondritic Planetesimals. Keynote*, cosmochemistry, 2014 Goldschmidt Conference.
- 6 March 2014 *Mercury Dome*, participatory data exploration for MESSENGER Science Team in the Hayden Planetarium.
- 26 Aug 2013 *Constraints on Astrophysical Disk Models from Chondritic Meteorites.*
 Stearns Colloquium, Earth & Environmental Sci. Dept., Wesleyan University, CT.
- 3 May 2012 *Mercury: Formation Hypotheses and MESSENGER Evidence.* University of Washington.
- 19 Apr 2012 *Interplanetary Dust, Meteorites, and Planets.* Lyceum Society of NYAS.
- 17 Mar 2012 Keynote, Brown-Vernadsky Symposium (before LPSC).
- 23 Jan 2012 *The First Solids of the Solar System: Phenomenology and Dynamics,*
 Dept. of Physics and Astronomy, University of Rochester.
- 9 Nov 2011 *MESSENGER: Constraints on Mercury’s Origin*, 24th MESSENGER Science Team Mtg.
- 25 Feb 2011 *Gas-Liquid-Solid Equilibria in Protoplanetary Disks: From Primitive Materials to Mercury’s Origin,* Dept. of Geosciences, Princeton University.
- 19 Nov 2009 *Physical Processes in the Early Solar System: Evidence from Space Rocks,* NYU Physics.
- 7 July 2009 *Constraints on Dust Processing and Accretion from Comet and Meteorite Petrology,*
 Gordon Research Conference: Origins of Solar Systems, invited speaker.
- 1 April 2009 *Comet & Meteorite Constraints on Astrophysical Disk Models,* NASA Ames Research Lab.
- 31 Mar 2009 *Meteorite Constraints on Solar System Models,* U. California, Berkeley.
- 2 Feb 2009 *Chemical & Isotopic Histories of the Earliest Igneous Rocks,* U. Wisconsin, Madison.
- 26 Feb 2008 *Meteorites: Entry point for Chemistry at AMNH,*
 Scientific Literacy /Scientific Frontiers Seminar group, Columbia U.
- 20 Oct 2007 *Questions Raised by Stardust Mission Results,* Astronomical Society of New York.
- 19 Oct 2007 *Meteorites: Evidence of Early Solar System Accretion,* American Physical Soc. NY sec.
- 7 June 2007 *Microtomographic, Petrologic and Isotopic Observations of the Accretion Histories of Chondrules,* Invited speaker, Symposium on Antarctic Meteorites, NIPR, Japan.
- 10 Nov. 2006 *New Discoveries from Microtomography of Meteorites,* U. Chicago.
- 28 May. 2005 Invited speaker, Symposium for John Wood, Harvard.
- 23 Feb. 2005 *Spinel Condensates from the Chicxulub Impact Plume,* Arizona State U.
- 22 Feb. 2005 *Condensation Chemistry of Protoplanetary Disks,* U. Arizona; Lunar Planet. Lab.
- 28 Feb. 2003 *Tomography of Meteorites,* Advanced Photon Source, Argonne National Lab
- 20 Nov. 2002 *First Rocks in the Solar System,* Rutgers University.

- 19 Aug. 2002 Invited talk, 12th Annual V.M. Goldschmidt Conference.
 15 Aug. 2002 Lecture, Institut für Mineralogie und Geochemie, Universität zu Köln.
 16 Jan. 2002 *Condensation, Crystallization, and Evaporation of Rocks in Astrophysical Environments*, Carnegie Institution of Washington.
 May 2001 Invited talk, 11th Annual V.M. Goldschmidt Conference.
 June 1999 Co-convenor, AGU session, *Magmatic Sulfide in the Crust, Mantle, Core*.
 Feb. 1999 *Spinel in Spherules at the K/T Boundary*, Geochem. Seminar, U. Chicago
 Oct. 1998 Invited talk, International Space Science Institute workshop, "Dust in the Local Interstellar Medium", Bern, Switzerland.

INVITED PUBLIC PRESENTATIONS (selected)

- 19 Nov 2016 *SeismoDome 4: The Sights and Sounds of Earthquakes*. Hayden Planetarium.
 14 Jan 2016 *SeismoDome 3: The Sights and Sounds of Earthquakes*. Hayden Planetarium.
 (now including analysis of microseismic data)
 15 Jul 2015 Co-presenter, *Breakfast at Pluto*, AMNH
<http://www.amnh.org/calendar/breakfast-at-pluto>
 20 Dec 2014 *Astronomy Night: Orion!* Intrepid Sea, Air & Space Museum Complex, NY.
 3 Dec 2014 AMNH Sci-Cafe: *Imaging Space Rocks* (with A. White and E. Crapster-Pregont)
 17 Nov 2014 *SeismoDome 2: The Sights and Sounds of Earthquakes*. Hayden Planetarium.
 25 Jan 2014 *SeismoDome 1: The Sights and Sounds of Earthquakes*. Hayden Planetarium.
 (NSF EarthScope funded group presentation with B. Holtzman and J. Candler)
 11 Oct 2013 *Asteroids: Science, Resources, Security*. Scarsdale High School, Galaxy Forum Lecture.
 14 Aug 2010 *Earth, Meteorites, and the Dynamic Solar System*, Montauk Observatory, New York.
 9 June 2009 *Meteorites & Comets: Chemical Tracers of the Birth of the Solar System*,
 LI-American Chemical Society 19th High School Awards Dinner, St. Johns U.
 1 May 2009 *Science Return from Stardust and Genesis Missions*, Amateur Astronomers Assoc. of NY.
 23 Oct. 2003 *Science of the Arthur Ross Hall of Meteorites*, Curator Lecture, AMNH.

PROFESSIONAL SERVICE

- Aug 16-Jun 18 **NASA Planetary Data System Roadmap Study Team**
 Jan 14-Dec 16 Publications Committee, The Meteoritical Society (Chair since Jan 2016)
 2015 Local Organizing Committee, 78th Meteoritical Society mtg., Berkeley CA 2015.
 2014 Program Committee, 77th Meteoritical Society mtg., Casablanca, Morocco 2014.
 Sep 12-present External Advisory Committee, North East National Ion Microprobe Facility (Woods Hole)
 (<http://www.who.edu/page.do?pid=18655>)
 Nov 2012 Local Organizer, 4th Joint MESSENGER-BepiColombo Meeting, New York 2012.
 (this meeting was rescheduled to Chicago, April 2013 due to hurricane Sandy)
 Mar 12-Mar 14 Nominating Committee, The Meteoritical Society
 Mar 12-present **Curation Informatics subcommittee of NASA CAPTEM.**
 (Curation and Analysis Planning Team for Extraterrestrial Materials)
 Jan 12-Apr 13 Program committee, 4th Joint MESSENGER-BepiColombo Science Team Meeting.
 2011 - 2013 Co-chair, theme team "Cosmochemistry and Planetary Science", 2013 Goldschmidt Conf.
 January 2011 Program committee, 42nd Lunar and Planetary Science Conference, Houston.
 2010-2011 Local Organizing Committee, 74th Meteoritical Society mtg., Greenwich, UK 2011.
 2009-2010 **Chair, Local Organizing Committee, 73rd Meteoritical Society mtg., New York 2010.**

May 2010 Program committee, 73rd Annual Meteoritical Society Meeting, New York.
 January 2010 Program committee, 41st Lunar and Planetary Science Conference, Houston.
 January 2009 Program committee, 40th Lunar and Planetary Science Conference, Houston.
 2008, 2009 Judge, Nininger Award for best student paper, The Meteoritical Society (2 years).
 2007 - 2009 Chair, Audit Committee, The Meteoritical Society.
 2006 - present Participant (E/PO, Geochemistry Team), MESSENGER Science Team meetings.
 2003 - present **NASA review panel member and chair service not disclosed** (confidentiality agreements).
 2002 - present NSF and NASA proposal review (external).
 2003 - present proposal review, PSC-CUNY grant program.
 Aug. 2000 Program committee, 63rd Annual Meteoritical Society Meeting, Chicago.
 2000 - present manuscript review for *Geochimica et Cosmochimica Acta*, *Computers and Geosciences*, *Mineralogical Magazine*, *Meteoritics and Planetary Science*, *American Mineralogist*, *National Academies Press*, *Canadian J. Earth Sci.*, *S. African J. Geology*, *PNAS*, *Chemie der Erde*, and other journals.

EDUCATIONAL SERVICE (selected items, through May, 2016)

fall 2018 Mentor, Kade graduate fellow J. Barosch (U. Köln; meteorite cosmochemistry)
 summer 2018 Mentor, REU student TBD
 summer 2017 Mentor, REU D. DeFelice (Juniata College; trace elements in inclusions in H chondrites)
 Aug 16 - present Principal advisor, **Ph.D. student** M. Gemma, Columbia U. (Earth & Environ. Sci.).
 summer 2016 Mentor, REU K. Greeley (Bridgewater State; trace elements in inclusions in LL chondrites)
 spring 2016 Mentor, SSERVI research trainee M. Gemma (planetary lab spectroscopy)
 fall 2015 Mentor, research intern M. Gemma (modeling condensation in disks)
 July 14, 2015 Co-presenter, "Breakfast at Pluto" event, AMNH (New Horizons mission)
<http://www.amnh.org/calendar/breakfast-at-pluto>
 summer 2015 Co-mentor, REU J. Christoph (William & Mary; REE of inclusions in CV chondrites)
 summer 2015 Co-mentor, summer research intern M. Gemma (REE of inclusions in CR chondrites)
 summer 2015 Mentor, SSERVI research trainee S. Mahmood (astronomical spectroscopy of minerals)
 spring 2015 Mentor, research intern S. Mahmood (shocked quartz at K-Pg sites in NJ)
 fall 2014 Instructor "Microscopy and Imaging Methods", Richard Gilder Graduate School, AMNH.
 fall term 2014 Research course (1 credit), A. Lobo (Columbia DEES, B.S. 2015)
 summer 2014 Mentor, summer research intern A. Lobo (image analysis of ordinary chondrites)
 summer 2014 Co-mentor, REU K. Hobart (Oberlin; EBSD/SEM/EPMA of inclusions in chondrites)
 summer 2014 Co-mentor, SSERVI research trainee L. Neil (spectroscopy and mineralogy of chondrites)
 Mar - May 2014 Mentor, Kade graduate fellow G. Budde (U. Münster; CAI isotope chemistry)
 Nov 13 - Jan 15 Principal advisor, post-doctoral researcher A. Vorbürger (MESSENGER data analysis).
 Oct 13 - Sep 15 Mentor, research student A. Lobo (Columbia U.; image analysis of ordinary chondrites)
 summer 2013 Co-mentor, summer research intern A. Lobo (image analysis of ordinary chondrites)
 summer 2013 Co-mentor, REU intern J. Bayron (Hunter College; image analysis of CR chondrites)
 summer 2013 Co-mentor, summer research intern I. Erb (image analysis of CR chondrites)
 summer 2013 Co-mentor, REU intern R. Goldman (Pomona College; CT of CAIs in CO chondrites)
 Apr - Jun 2013 Mentor, Annette-Kade graduate fellow C. Loesche (U. Duisburg-Essen; photophoresis)
 13 Jun 2012 *Meteorites, Solar System Chemistry, and MESSENGER at Mercury: An Extended Discussion*.
 Evening class for the Amateur Astronomers Association of New York.
 2011 - 2017 Advisor, Ph.D. student J. Anton, CUNY (Earth & Environ. Sci.; defense 19-Dec-2017).
 Aug 12 - Jul 16 Principal advisor, AMNH MAT post-doctoral fellow Dr. Gokce Ustunisik (exp. petrology)

Jun 12 - Aug 14 Principal advisor, **M. S. student** A. Ansari, Columbia U. (Earth & Environ. Sci.).
 summer 2011 Mentor, summer research intern T. Tielebein, LCSM image analysis for Stardust samples.
 22 Feb 2012 *First Solids in the Solar System*. Lecture to Fordham chemistry research class.
 Dec 11 - Jun 13 Mentor, research volunteer R. Aldoroty, K/Pg boundary geochem. in NJ coastal plain..
 2011 - 2017 Advisor, Ph.D. student J. Bigolski, CUNY (Earth & Environ. Sci.; defense 9-Aug-2017).
 Jul 11- Jul 16 Mentor, pre-doc intern A. White (B.S., Drexel), LCSM imaging of Stardust samples.
 summer 2011 Mentor, summer research intern M. Hill, CT and SEM analysis of CO chondrites.
 summer 2011 Mentor, summer research intern J. Bigolski, K/Pg boundary geochem. in NJ coastal plain.
 summer 2011 Mentor, summer research intern J. Schoaf, petrology of CR chondrites (St. John's).
 Mar 17, 2011 Organizer and host of MESSENGER orbital insertion public event, AMNH.
 2010 - 2017 Principal advisor, **Ph.D.** E. Crapster-Pregont, Columbia (Earth & Env. Sci. defense 28-Mar)
 Sep 08-Aug 11 Mentor, pre-doc intern M. Greenberg (B.S., Brandeis), LCSM imaging of Stardust tracks.
 2008 - 2012 Advisor, Ph.D. student C. McNally, Columbia U. (Astronomy, defense 2012).
 2006 - 2011 Advisor, Ph.D. student A. Buono, Columbia U. (Earth & Environmental Sci., defense 2011).
 Sep 05- Mar 15 AMNH Education/Public Outreach representative, MESSENGER science team.
 2001 - present Many TV, radio and newspaper interviews on meteorites, NASA missions, etc.
 Sep 09-Sep 10 Co-mentor, student intern A. Nissinboim (Brooklyn Coll.), astrophys. lab spectroscopy.
 Aug 2010 Lecture/tour for teacher training program, AMNH (TRUST successor).
 Jul 10-Sep 2010 Mentor, pre-doc research, E. Crapster-Pregont, petrology/cosmochemistry (Columbia).
 Jun 10-Sep 10 Mentor, intern J. Bigolski (MS), NJ K/T sequence strat. (Lecturer, CUNY Kingsborough).
 summer 2010 Mentor, summer research intern I. Erb, petrology of CR chondrites (Wellesley).
 summer 2010 Mentor, 'Research Experience for Undergraduates', M. Downen (W. KY U.).
 summer 2010 Mentor, summer research intern R. Roberts, mapping chondrites by SEM (CUNY).
 May 10-Aug 10 Mentor, pre-doc intern K. Konrad (B.A.), cosmochemistry sample analysis (U. Oregon).
 Feb 10-Aug 10 Mentor, intern C-T. Hsieh (M.S., Oregon), chemical sedimentary history of NJ K/T.
 Sep 09-Sep 10 Mentor, undergrad intern E. Lewis (U. Chicago), meteorite/mineral spectra web database.
 Dec 08-July 10 Mentor, pre-doc intern K. Sherman (Barnard), cosmochemistry sample analysis (U. CO).
 Aug 07-Aug 10 Instructor of Record, AMNH teaching program with Lehman College (TRUST successor).
 summer 2009 Mentor, student intern S. McKnight (Mt. Holyoke), cosmochemistry sample analysis.
 summer 2009 Mentor, high-school intern P. Hein (Manhattan), cosmochemistry sample preparation.
 summer 2009 Co-mentor, student intern A. Nissinboim (Brooklyn Coll.), astrophys. lab spectroscopy.
 summer 2009 Mentor, student intern S. Ramcharan (Columbia), Stardust sample imaging and S-XRF.
 summer 2009 Mentor, 'Research Experience for Undergraduates', K. Konrad (CUNY-Queens).
 Sep 08-Jun 09 Mentor, AMNH H.S. Science Research program, M. Lu (Stuyvesant), meteorite petrology.
 Sep 08-Jun 09 Mentor, H.S. Science Research program, I. Erb (home school), meteorite petrology.
 July 2008 Lectures/tours (4) for 'TRUST' teacher training program, AMNH.
 summer 2008 Mentor, high-school interns C. O'Rourke and M. Leventhal.
 summer 2008 Mentor, student intern M. Greenberg (Brandeis U.), imaging of Stardust samples
 summer 2008 Mentor, 'Research Experience for Undergraduates' K. Leftwich (W. KY U.)
 summer 2008 Co-mentor, student intern A. Nissinboim (Brooklyn Coll.), astrophys. lab spectroscopy.
 26 May 2008 Mars Phoenix Lander public Q&A event in Rose Center
 May 08-Aug 09 **Co-curator, AMNH/Cornell exhibition, *Saturn: Images from the Cassini Mission.***
 February 2009 Co-author with N. deG. Tyson 'Solar System' on-line Seminars in Science course
<http://www.amnh.org/learn/solar>
 summer 2007 Mentor, intern M. Greenberg (Brandeis U.), imaging of Stardust samples
 summer 2007 Mentor, 'Research Experience for Undergraduates' C. Brunner (W. KY U.)

summer 2007 Mentor, high-school interns G. Lutzky and J. Finkelstein.
 2002 - 2007 Ph.D. committee member for J. Boesenberg, Rutgers U. (Geology).
 August 2006 Lectures/tours (3) for 'TRUST' teacher training program, AMNH.
 Nov 04-Aug 06 Mentor, AMNH **post-doctoral Kalbfleisch fellow**, Dr. Jon Friedrich
 (now Assoc. Professor of Chemistry, Fordham University, New York)
 7-9 July 2006 Invited guest and speaker, First Annual Meteorite Festival, Haviland, Kansas.
 July 2006 Lectures/tours (3) for 'TRUST' teacher training program, AMNH.
 summer 2006 Mentor, summer interns J. Wittenzellner (Wells College), J. Oram (Oberlin)
 summer 2006 Mentor, 'Research Experience for Undergraduates' H. Rodriguez (U. TX El Paso)
 July 2005 Lectures/tours (3) for 'TRUST' teacher training program, AMNH.
 summer 2005 Mentor, summer H.S. intern A. Bergin
 summer 2005 Mentor, 'Research Experience for Undergraduates' J. Bigolski.
 summer 2005 Mentor, summer student S. Hylton (currently at SUNY Stony Brook)
 April 2005 Appearance in History Channel special, *Meteors: Fire from the Sky*.
 31 Mar 2005 Tour and presentations to 'Members Open House', AMNH.
 3 Jan 2005 Tour and presentation to AMNH Urban Advantage student group.
 2 Nov 2004 Tour and presentation for teacher development workshops (2 groups of 15)
 Oct 04-Jun 05 Senior thesis advisor, S. Hylton, MIT (with Dr. T. Grove, Geology)
 Aug 2004 Presentation to NASA - SHARP program student group.
 July 2004 Lectures/tours (3) for 'TRUST' teacher training program, AMNH.
 2 July 2004 Tour and presentation for Grand Ronde student interns.
 1 July 2004 Tour and presentation for summer Saltz cart student intern hall explainers.
 4-6 Apr 2004 K-6, Middle, High School, and public lectures, Barrow AK.
 summer 2004 Mentor, 'Research Experience for Undergraduates' S. Baughman and S. Hylton
 Oct 03 - Jun 04 Mentor, AMNH 'Inside View' high school intern J. Laverde
 Jan - Mar 2004 Mentor, Annette-Kade graduate fellow T. Shoenbeck (U. Cologne)
 Jan 24-25 2004 Conducted institute for ~40 teachers at AMNH (see grants, above)
 9 Jan. 2004 Lecture, Westchester Amateur Astronomers Assoc.
 3 Oct. 2003 Lecture, Amateur Astronomers Assoc. of New York
 2001 - 2003 **Lead Curator, new Arthur Ross Hall of Meteorites, AMNH.**
 summer 2003 Mentor, 'Research Experience for Undergraduates' student N. Costello
 Sep-Oct 2003 Mentor, Ph.D. visiting scholar A. Engler, U. Vienna
 summer 2002 Mentor, CUNY student in "Precollege Science Collaborative Program"
 summer 2002 Mentor, college intern J. Murray (Colgate U.)
 2001 - 2003 Mentor, high school intern J. Hertz (Columbia Prep., Columbia '07)

COURSES

spring 2018 "Chemical Geology" (W4009), Dept. Earth & Environmental Sci., Columbia.
 fall 2017 Instructor, "Microscopy and Imaging Methods for Comparative Biology", RGGGS
 spring 2016 "Chemical Geology" (W4009), Dept. Earth & Environmental Sci., Columbia.
 spring 2015 Co-teaching "Extinction Science" (RGGGS660), Richard Gilder Graduate School, AMNH.
 fall 2014 Instructor, "Microscopy and Imaging Methods for Comparative Biology", RGGGS
 2011 - present Co-teaching "Research Practicum", second summer field/lab residency,
 AMNH Master of Arts in Teaching Earth Sciences <http://www.amnh.org/education/mat/>

COLUMBIA COMMITTEES

- Oct 17 - present Search Committee, Experimentalist, Dept. Earth + Environmental Sciences
- Sep 15 - present Curriculum and Teaching Committee, Dept. Earth + Environmental Sciences

AMNH COMMITTEES

- Sep 17 - present Academic Affairs and Fellowships Committee of the RGGS (AAFC)
- Sep 17 - present Astrophysics Curatorial Search Committee
- Jul 16 - Dec 17 Chair, EPS Curatorial Search Committee
- Sep 16 - present Chair, Science Support Committee of the Senate of the Scientific Staff
- Sep 15 - present MAT Academic Affairs and Program Committee (MAAPC)
- Sep 14 - Aug 16 Chair, Senate of the Scientific Staff of the AMNH
- Sep 12 - present Scientific Staff Steering Committee
- Sep 12 - Aug 14 AAFC Working Group for Postdoctoral Fellows
- Sep 10 - present Finance and Compensation Committee of the Senate of the Scientific Staff
- Sep 10 - Sep 16 Science Support Committee of the Senate of the Scientific Staff
- Sep 12 - Aug 14 Vice-chair, Senate of the Scientific Staff of the AMNH
- Sep 12 - Aug 14 Appointments and Promotions Committee of the Senate of the Scientific Staff (A+P)
- Sep 11 - Aug 13 Academic Affairs and Fellowships Committee of the RGGS (AAFC)
- Sep 10 - present Executive Committee of the Senate of the Scientific Staff
- Sep 10 - Sep 14 Chair, Science Support Committee of the Senate of the Scientific Staff
- Sep 08 - Aug 10 Appointments and Promotions Committee of the Senate of the Scientific Staff (A+P)
- Sep 07 - Aug 10 Microscopy & Imaging Facility Committee of the Senate of the Scientific Staff
- Sep 07 - Aug 10 Exhibitions Review Committee of the Senate of the Scientific Staff
- Sep 04 - Aug 10 Information Technology Committee of the Senate of the Scientific Staff
- Spring 2004 Astrophysics Curatorial Search Committee
- Jan 02 - Aug 08 Chair, Shop Advisory Committee of the Senate of the Scientific Staff
- Sep 01 - Jan 02 Shop Advisory Committee of the Senate of the Scientific Staff

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