

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 Full Professor, <u>Dept. Earth & Environmental Sci.</u> , Columbia U.
2015-present	Faculty, <u>Master of Arts in Teaching</u> , RGGS
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 (RGGS)</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 (RGGS), 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 (peer reviewed, accepted)

- (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 (in press)
- (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.
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- (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.
- (2015) **The origin of chondrules: constraints from matrix composition and matrix-chondrule complementarity.** Palme, H., D. C. Hezel, and D. S. Ebel. *Earth and Planetary Science Letters* **411**: 11-19. DOI: 10.1016/j.epsl.2014.11.033
- (2015) **Chondrule size and density in all meteorite groups: A compilation and evaluation of current knowledge.** Friedrich, J. M., M. K. Weisberg, D. S. Ebel, A. E. Biltz, B. M. Corbett, I. V. Iotzov, W. S. Khan, and M. D. Wolman (invited review) *Chemie der Erde*, **75**, 419-443. DOI: 10.1016/j.chemer.2014.08.003 or arXiv:1408.6581 [astro-ph.EP]
- (2014) **Nebular paleomagnetism.**
Fu, R. R., B. P. Weiss, E. A. Lima, R. J. Harrison, X.-N. Bai, C. Suavet, D. S. Ebel, T. Kasama, H. Wang, S. J. Desch, and A. T. Kuan. *Science* **346**: 1089-1092. DOI: 10.1126/science.1258022
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White, A. J. and D. S. Ebel. *Microscopy and Microanalysis*. Published online: 17 December 2014. DOI: 10.1017/S1431927614013610
- (2014) **Experimental investigation of condensation predictions in dust-enriched systems.**
Ustunisik, G, D. S. Ebel, D. Walker, and J. S. Boesenberg. *Geochimica et Cosmochimica Acta* **142**: 27-38. DOI: 10.1016/j.gca.2014.07.029

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- (2013) **Metal veins in the Kernouvé (H6 S1) chondrite: Evidence for pre- or syn-metamorphic shear deformation.** Friedrich J. M., A. Ruzicka, M. L. Rivers, D. S. Ebel, J. O. Thostenson, R. A. Rudolph. *Geochimica et Cosmochimica Acta* **116**: 71-83. (dx.doi.org/10.1016/j.gca.2013.01.009)
- (2013) **Mineral processing by short circuits in protoplanetary disks.** McNally C.P., A. Hubbard, M-M. Mac Low, D.S. Ebel, and P. D'Alessio. *Astrophysical J Letters* **767**: L2-7. DOI:10.1088/2041-8205/767/1/L2 (arXiv:1301.1698)
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- (2012) **Questions, questions: Can the contradictions between the petrologic, isotopic, thermodynamic, and astrophysical constraints on chondrule formation be resolved?** Alexander, C. M. O'D. and D. S. Ebel. *Meteoritics and Planetary Science* **47**: 1157-1175.
- (2012) **Properties of original impactors estimated from three-dimensional analysis of whole Stardust tracks.** Greenberg, M., and D. S. Ebel *Meteoritics and Planetary Science* **47**: 634-648.
- (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.
- (2011) **The major-element composition of Mercury's surface from MESSENGER x-ray spectrometry.** Nittler, L. R., R. D. Starr, S. Z. Weider, T. J. McCoy, W. V. Boynton, D. S. Ebel, C. M. Ernst, L. G. Evans, J. O. Goldsten, D. K. Hamara, D. J. Lawrence, R. L. McNutt Jr., C. E. Schlemm II, S. C. Solomon, and A. L. Sprague. *Science* **333**: 1847-1850.
- (2011) **Laboratory experiments bearing on the origin and evolution of olivine-rich chondrules.** Richter, F. M., R. A. Mendybaev, J. N. Christensen, D. S. Ebel, and A. Gaffney. *Meteoritics and Planetary Science* **46**: 1152-1178.
- (2011) **Equilibrium condensation from chondritic porous IDP enriched vapor: Implications for Mercury and enstatite chondrite origins.** Ebel, D. S., and C. M. O'D. Alexander *Planetary and Space Sciences* **59**: 1888-1894. doi:10.1016/j.pss.2011.07.017.
- (2011) **Sulfur in extraterrestrial bodies and the deep Earth.** Ebel, D.S. In *Sulfur in Magmas and Melts: Its Importance for Natural and Technical Processes*, ed. H. Behrens, J. D. Webster. *Reviews in Mineralogy & Geochemistry* **73** Mineralogical Society of America, pp. 315-336.
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- (2010) **Far infrared spectroscopy of the carbonate minerals.** Brusentsova, T. N., R. E. Peale, D. Maukonen, G. E. Harlow, J. S. Boesenberg, and D. S. Ebel. *American Mineralogist* **95**: 1515-1522.
- (2010) **Laser scanning confocal microscopy of comet material in aerogel.** Greenberg, M. and D. S. Ebel. *Geosphere* **6**: 515-523.
- (2009) **Incompletely compacted equilibrated ordinary chondrites.** Sasso, M.R., R.J. Macke, J.S. Boesenberg, D.T. Britt, M.L. Rivers, D.S. Ebel and J.M. Friedrich. *Meteoritics and Planetary Science* **44**: 1743-1753.
- (2009) **3-dimensional textural and compositional analysis of particle tracks and fragmentation history in aerogel.** Ebel D.S., M. Greenberg, M.L. Rivers and M. Newville. *Meteoritics and Planetary Science* **44**: 1445-1463.
- (2009) **Laser ablation - inductively coupled plasma - mass spectrometry and its application in geochemistry, cosmochemistry and environmental research.** Jochum, K.P., B. Stoll, J.M. Friedrich, A. Marghaleray, S. Becker, M. Dücking, D.S. Ebel, J. Enzweiler, H. Ming-yue, D. Kuzmin, R. Mertz-kraus, W.E.G. Müller, J. Regnery, A. Sobolev, X-h. Wang, and X. Zhan. *Rock and Mineral Analysis* **28**: 53-68.
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- (2008) **Pore size distribution in an uncompactd equilibrated ordinary chondrite.** Friedrich J.M., R.J. Macke, D.P. Wignarajah, M.L. Rivers, D.T. Britt, and D.S. Ebel. *Planetary and Space Science*. **56**: 895-900. (doi:10.1016/j.pss.2008.02.002)
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- (2000) **Major element chemical and isotopic compositions of refractory inclusions in C3 chondrites: The separate roles of condensation and evaporation.** Grossman, L., D.S. Ebel, S.B. Simon, A.M. Davis, F.M. Richter, and N.M. Parsad. *Geochimica et Cosmochimica Acta*, **64**: 2879-2894.
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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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- (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”
- 2001-2010 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)

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-present **NASA Planetary Data System Decadal Roadmap Committee**
- 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 <i>Geochimica et Cosmochimica Acta</i> , <i>Computers and Geosciences</i> , <i>Mineralogical Magazine</i> , <i>Meteoritics and Planetary Science</i> , <i>American Mineralogist</i> , <i>National Academies Press</i> , <i>Canadian J. Earth Sci.</i> , <i>S. African J. Geology</i> , <i>PNAS</i> , <i>Chemie der Erde</i> , and other journals.

EDUCATIONAL SERVICE (selected items, through May, 2016)

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. Vorburger (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.
- 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 - present Advisor, Ph.D. student J. Bigolski, CUNY (Earth & Environ. Sci.).
- 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 - Jul 17 Principal advisor, **Ph.D. student** E. Crapster-Pregont, Columbia U. (Earth & Environ. Sci.).
- Sep 08-Aug 11 Mentor, pre-doc intern M. Greenberg (B.S., Brandeis), LCSM imaging of Stardust tracks.
- 2008 - 2012 Ph.D. committee member for C. McNally, Columbia U. (Astronomy).
- 2006 - 2011 Ph.D. committee member for A. Buono, Columbia U. (Earth & Environmental Sci.).
- 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
- 2002 - 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 2016 “Chemical Geology” (W4009), Dept. Earth & Environmental Sci., Columbia.
- spring 2015 Co-teaching “Extinction Science” (RGG5660), Richard Gilder Graduate School, AMNH.
- 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

Sep 15 - present Curriculum and Teaching Committee, Dept. Earth + Environmental Sciences

AMNH COMMITTEES

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

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