CURRICULUM VITAE OF STEPHEN JAMES MOJZSIS

Citizenship: USA, Hungary, Ireland

Professor of Geology, Chair of Arts & Sciences Council
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Skype: steve.mojzsis ISI Web of Science *h-index* = 31; Google scholar *h-index* = 40, *i10-index* = 72 (7095 citations); *Q = 8*

RESEARCH INTERESTS

I am Earth scientist who uses physical, chemical and dynamical tools to understand the natural world. My research is field-, laboratory- and modeling-based, and explores the planetary-scale geodynamic conditions that give rise to planets such as Earth, including those that may host a biosphere. I use solid state physical chemical techniques to interrogate the ancient geologic and meteoritic record to explore the natural world. My studies in planetary crustal processes have led me to broad applications, especially coupled U-Th-Pb zircon geochronology and crystal chemistry with other isotopic techniques (Lu-Hf, Sm-Nd, C-, O-, S-, Si-isotopes) applied to minerals and rocks. I am also a field geologist, and document field relationships in gneiss terranes by high-resolution mapping at the appropriate scale (1:5-1:1000) to guide detailed sampling for geochemistry and geochronology. I have led novel instrument applications development, mostly with secondary ion mass spectrometry (multi-collector ion microprobe; SIMS) and multi-collector inductively coupled plasma mass spectrometry (MC-ICP-MS) for combined U-Pb zircon, Lu-Hf, ^{147,146}Sm-^{143,142}Nd and W isotope studies rocks and meteorites. Similarly, I have used SIMS for multiple S-, Si- and O-isotope studies of the oldest minerals of Earth, Mars and asteroidal meteorites. I use solar system solids as chemical, thermal and chronological archives. As such, I investigate pre- and post- closure temperature thermal chemical diffusion models of the important accessory minerals. My work has tracked the evolution of atmospheric oxygen as it relates to evolution of biogeochemical cycles using multiple S isotopes and trace metals (Ni, Co). My field area is the inner solar system, but is not confined to it because I also have my eye on exoplanets; I term this new science *Geoastronomy*. To this end, I have constructed geochemically- and cosmochemically-plausible models for the thermal structure of planetary objects including Earth, Moon, Mars, Mercury, and various asteroids, and have extrapolated to Kuiper Belt/Trans-Neptunian Objects. New work involves better understanding the nature of Exoplanets. Lately, I have been actively working on planet formation theory and planetary dynamics coupled with cosmochemistry, and galactic chemical evolution models.

PROFESSIONAL PREPARATION

University of California Los Angeles; Postdoctoral Scholar with T.M. Harrison	2000
Scripps Institution of Oceanography; Ph.D. Earth Sciences with G.O. Arrhenius	1997
Boston University, Boston, Massachusetts; M.A. Geology with F. El-Baz	1992
Boston University, Boston, Massachusetts; B.A. Geology (hon.) with L. Margulis	1988

PROFESSIONAL APPOINTMENTS

2020	Visiting Scholar, Kavli Institute for Theoretical Physics, Santa Barbara, California
2019	Professeur Invité, University of Lorraine/CNRS-CRPG, Nancy, France
2019	Scholar, Erwin Schrödinger Institute of Mathematics and Physics, Vienna, Austria
2018	Visiting Professor, Department of Earth Sciences, ETH, Zürich, Switzerland
2017-2020	Chair, College of Arts & Sciences Council of the University of Colorado
2016-*present*	Director, the Collaborative for Research in Origins (CRiO)
2000-*present*	Assistant (2000), Associate (2007), Full (2014) Professor of Geology
2015-2017	Visiting Professor, Earth-Life Science Institute, Tokyo Institute of Technology, Japan
2013-*present*	Distinguished Professor, Hungarian Academy of Sciences, Budapest, Hungary
2011-2013	Professeur des universités (2^{e}), Université Claude Bernard Lyon 1, France
2008-2009	Director, Science Education Initiative, Geological Sciences, University of Colorado
2007-2008	CNRS & Fulbright Visiting Professor of Geochemistry, CNRS-CRPG Nancy, France
2001-2008	Associate Director, University of Colorado Center for Astrobiology
1999-2000	Adjunct Assistant Professor of Geochemistry, University of California Los Angeles
1998-2000	NSF Earth Sciences Postdoctoral Fellow, University of California Los Angeles
1997-1998	President's Postdoctoral Fellow, UCLA
1998-2000	Asst. Researcher, Institute for Pure & Applied Physical Sciences, UCSD
1995-1997	NSCORT Graduate Research Fellow, Scripps Institution of Oceanography, UCSD
1993-1997	Graduate Research Assistant, Scripps Institution of Oceanography, UCSD
1992-1993	Research Associate, Scripps Institution of Oceanography, UCSD
1988-1992	Graduate Research Assistant in Geology, Boston University
1988	Research Associate Hydrogeochemist, United States Geological Survey, Cape Cod, MA
1987	NASA Summer Undergraduate Intern, Lunar and Planetary Institute, Houston, TX

MEMBERSHIP IN PROFESSIONAL SOCIETIES

American Geophysical Union / European Association of Geochemistry / European Geosciences Union

Europlanet / Geochemical Society / International Fulbright Association / Sigma Xi / International

Society for the Study of the Origin of Life

PROFESSIONAL SERVICE ACTIVITIES (2007-2020)

- **Departmental and College Service**: *Director of the Science Education Initiative Geological Sciences Node (2008-2009); Chair Graduate Admissions Committee (2013-2015, 2019-2020); Chair, Arts & Sciences Council of the University of Colorado at Boulder (2017-2020); Member Provost's Committee on Faculty Governance (2019-2020); Ex-officio member Boulder Faculty Assembly, CMCI*
- **President**: *Division on Planetary and Solar System Sciences, European Geosciences Union (2020-2022)*

- **Editorial Board**: *Geobiology, Astrobiology (until 2014);* ***Associate Editor****: Central European Geology (formerly Acta Geologica Hungarica); Central European Journal of Geosciences; Heliyon (Elsevier, until 2017);* **Subject Editor**: *Geobiology, Space Science Reviews,* and *Precambrian Research*
- **Voting/Participating Member**: *International Commission on Stratigraphy, Sub-commission on Precambrian Stratigraphy; International Board Member, European Astrobiology Institute*
- **Regular peer reviewer**: *Nature, Nature Geoscience, Science Communications, Science, Earth & Planetary Science Letters, Geochimica et Cosmochimica Acta, Journal of Geophysical Research – Planets, Journal of Geology, Chemical Geology, Geochemistry Journal, Astrobiology, Geobiology, Precambrian Research, Contributions to Mineralogy and Petrology, American Journal of Science, Reviews in Geochemistry and Mineralogy, Proceedings of the National Academy of Sciences, Journal of Asian Earth Sciences, Geology, Tectonophysics, Meteoritics and Planetary Science*
- **Regular external reviewer**: *NASA programs in Solar System Workings, Habitable Worlds, Emerging Worlds, Exobiology and Astrobiology, Mars Fundamental Research; NSF programs in Instrumentation and Facilities, Geology and Paleontology, Geochemistry and Petrology, Geobiology and Low-temperature geochemistry; NRC (UK) Programs in Environmental Sciences; NWO (Netherlands) Program in Chemistry & Biochemistry; Australian Research Council (ARC); Agence Nationale de Recherche (French National Science Foundation); European Science Foundation; European Research Council; Swiss National Science Foundation; Deutsche Forschungs Gemeinschaft (German National Science Foundation), National Science Foundation of Poland, National Science Foundation of Hungary*
- **Panelist**: *NASA Exobiology, and Cosmochemistry; NSF Graduate Student Research Fellowship Program; NASA Postdoctoral Program; NASA Astrobiology Roadmap Planning Committee 2014; DFG Schwerpunkt Programme, Germany 2015 & 2018*
- **Conference Program Chair**: *Early Life (École thématique 'Debut de la Vie') The Lyon Spring School 2012 (50 international participants, organized in France). "Astrobiology 2004", Boulder, Colorado (500 participants); "Before the Moon 2016", Tokyo, Japan (30 participants), "Before Life" 2017, Boulder, Colorado (30 participants); Co-Chair, Erwin Schroedinger Institute "Origins" 2019, Vienna, Austria (60 participants).*
- **Theme Chair**, "Early Earth Processes": *2008 V.M. Goldschmidt International Geochemistry Meeting, Vancouver, BC (Canada);* "Primitive Earth: From core to atmosphere": *2011 V.M. Goldschmidt International Geochemistry Meeting, Prague, (Czech Republic);* "Planetary Formation": *2015 Origins of Solar Systems GRC, Mt. Holyoke, MA*; "Early Earth": *2016 Goldschmidt Conference, Yokohama, Japan.*
- **Program or Scientific Organizing Committee Member**: *Impact Processes in the Solar System I, Lunar & Planetary Institute, 2008; Delivery of Volatiles to Earth and Exo-Earths, Space Telescope Science Institute, 2010; COST Action conference Life3E Search for life: from Early Earth to Exoplanets, Quy Nonh on March 25-29th 2019; Rencontres du Vietnam 2020*
- **Session Chair**, topics in geophysics, geochemistry, geobiology and cosmochemistry: *2013 EGU; 2018 AOGS; 2008 AGU; 2007, 2017 GSA; 2007, 2008, 2009, 2011, 2013, 2015, 2016, 2018 Goldschmidt Conferences; 2019 European Planetary Science Conference-DPS*

RECENT PRESENTATIONS (2018-2020)

Keynote presentations:

Gordon Research Conference, Origin of Life. Galveston, TX. January 2018
Earth-Life Science Institute, Tokyo Institute of Technology. Japan. May 2018
Ludwig-Maximilians-Universität München, Simons Foundation, Munich, Germany. October 2018
The John Templeton Foundation/FfAME Origins Program, Atlanta, GA. October 2018
MISASA International Symposium, Okayama, Japan. December 2018
The Nordic Astrobiology Network, Siljan, Sweden. June 2019
Erwin Schrödinger Institute for Mathematics & Physics. Vienna, Austria. July 2019
DAI International Science Festival, Heidelberg, Germany. December 2019
International Society for the Study of the Origin of Life, Quito, Ecuador August 2020
Rencontres du Vietnam, ICISE, Quy Nhon, September 2020
Kavli Institute for Theoretical Physics, Santa Barbara. September 2020

Invited talks/ Departmental & Institute colloquia:

European Geosciences Union, Vienna, AT. April 2018
Earth-Life Sciences Institute, Tokyo, Japan. May 2018
Asia-Oceania Geosciences Conference, Hawai'i. June 2018
University of Bern, CH. Earth Sciences, June 2018
University of Manchester, UK. Earth Sciences, June 2018
University of Heidelberg, Germany. Earth Sciences, June 2018
Max-Planck-Institute for Astronomy, Germany. June 2018
ETH, Switzerland, Earth Sciences. June 2018
University of Zurich, Switzerland, Physics. July 2018
Syracuse University, Earth Sciences, New York. Earth Sciences. December 2018
LMU Munich, Germany, Chemistry. July 2019
University of Oslo, Norway, CEED. September 2019
Arrhenius Symposium, University of California at San Diego, SIO. November 2019
Origins Week, TU Munich & MPI Extraterrestrial Physics. December 2019
Institute of Science and Technology – Austria. March 2020

HONORS AND AWARDS (with year of award)

Visiting Scholar, Kavli Institute for Theoretical Physics, UC Santa Barbara, 2020.
Faculty Scholar, Erwin Schrödinger Institute for Mathematics & Physics, Vienna (Austria), 2019
Distinguished Visiting Professor, University of Lorraine, Nancy (France), 2019
Visiting Professor, Geophysical Fluid Dynamics, ETH, Zurich (Switzerland), 2018
Full Member, Hungarian Academy of Sciences, 2016 (seated, 2017)
Distinguished Visiting Professor, Earth-Life Science Institute (ELSI), Tokyo, 2015
University of Colorado ASSETT Outstanding Teacher Award, 2014
Distinguished Visiting Professor, Geological Institute of the Hungarian Academy of Sciences, 2013

Fulbright Faculty Scholar (France), 2007
University of Colorado, Residence Life Teaching Award, 2004
Fellow, Institute of Geophysics and Planetary Physics (IGPP), University of California, 1998
Hickok-Radford Award for Geological Research in Polar Regions, SEG Foundation, 1997
Geological Society of America, Graduate Research Award, 1996
Edward A. Frieman Prize, Best Graduate Student Paper, Scripps Institution of Oceanography, 1996
Boston University Graduate Award for Excellence in Geology, 1987

BIBLIOGRAPHY

BOOKS

Mojzsis, S.J. (**IN PREP**) Origin of the biogeochemical cycles. *Wiley-Blackwell.* (Fall 2020)

Mojzsis, S.J. (**IN PREP**) Early life. *Elsevier Developments in Precambrian Geology* (Spring 2021)

PEER-REVIEWED MANUSCRIPTS

**TEN SIGNIFICANT WORKS ARE HIGHLIGHTED

Explanation: * Peer-reviewed Book chapters Underline = past or present Student or Postdoc author

WORK IN PREPARATION

Martins-Pimentel, R., Kelly, N.M., **Mojzsis**, S.J. (IN PREPARATION) A mid-Carboniferous age for the Santa Fe Impact Structure. for *Earth and Planetary Sciences Letters.*

Mojzsis, S.J. (IN PREPARATION) *Invited Review*: Fugacity evolution of terrestrial melts. for *Frontiers in Geosciences.*

Morrison, P. and **Mojzsis**, S.J. (IN PREPARATION) The antiquity of elemental sulfur reduction. *for Earth and Planetary Science Letters.*

Mojzsis, S.J., Brasser, R. et al. (IN PREPARATION) Augmentation to the solar system's protoplanetary disk by a molecular cloud filament. for *Monthly Notices Royal Astronomical Society*.

Mojzsis, S.J. Diercks, D.R., Huss, G. (IN PREPARATION) Atom probe tomographic analysis of presolar silicon carbide from the Orgueil (CI) chondrite. for *The Planetary Science Journal.*

Zawaski, M., Kelly, N.M., Orlandini, O.M., Allwood, A., Nichols, C. and **Mojzsis**, S.J. (NEAR COMPLETION) Structural and chemical analysis of proposed 3.7 Ga stromatolites supports abiotic origin. for *Earth and Planetary Science Letters.*

Biondi, E., Kim, H.J., **Mojzsis**, S.J, Benner, S.A. (NEAR COMPLETION) Catalytic synthesis of long RNA oligomers on prebiotic rock glasses. for *Science*

Abramov, O., Bebell, K.L., **Mojzsis**, S.J. (NEAR COMPLETION) Emergent bioanalogous properties of blockchain-based distributed systems. for *Nature.*

Chowdhury, W., Trail, D., Guitreau, M., Bell, E.A., Buettner, J., **Mojzsis**, S.J. (SUBMITTED) Geochemical and textural investigation of the Ukaliq Supracrustal Belt, Inukjuak Domain (NE Quebec, Canada). for *Lithos.*

PUBLISHED WORK

2020

Ritson, D.J., **Mojzsis**, S.J., Sutherland, J.D. (ACCEPTED) Phosphate in prebiotic Earth environments. *Nature Geosciences.*

Greer, J.C., Cates, N.L., Caro, G., Bleeker, W., Kelly, N.M., **Mojzsis**, S.J. (ACCEPTED) Polyphase Archean granitoid gneisses and supracrustal enclaves of the southern Inukjuak Domain, Quebec (Canada). *Lithos.*

Biondi, J.C., Polgári, M., Gyollai, I., Fintor, K., Kovács, I., Fekete, J, **Mojzsis**, S.J. (IN PRESS) Biogenesis of the Ediacaran Kremydilite manganese ores from Urucum (Brazil) – a new manganese ore type. *Precambrian Research.*

Brasser, R. and **Mojzsis,** S.J. (2020) The inner and outer solar system was partitioned by a structured protosolar disk. *Nature Astronomy. https://doi.org/10.1038/s41550-019-0978-6.*

Brasser, R., Werner, S.C., **Mojzsis**, S.J. (2020) Impact bombardment chronology of the terrestrial planets from 4.5 Ga to 3.5 Ga. *Icarus*, **338**, 113514.

2019

Benner, S.A., Bell, E.A., Biondi, E., Brasser, R., Carell, T., Kim, H-J., **Mojzsis**, S.J., Omran, A., Pasek, M.A., and Trail, D. (2019) When did Life Likely Emerge on Earth in an RNA-First Process? *ChemSystemsChem Reviews* DOI: 10.1002/syst.201900035.

Mojzsis, S.J., Brasser, R., Kelly, N.M., Abramov, O., and Werner, S. (2019) Onset of giant planet migration before 4480 million years ago. *The Astrophysical Journal*, **881***:*44 (13pp), 2019 August 10 doi.org/10.3847/1538-4357/ab2c03.

Woo, J.M.Y., Genda, H., Brasser, R., **Mojzsis**, S.J. (2019) Mars in the aftermath of a colossal impact. *Icarus*, **133**, 87-95.

Böhm, C., Cates, N.L., **Mojzsis**, S.J., Guitreau, M., Bourdon, B., Roth, A., Hartlaub, R.P., Heaman, L.M. (2019) The Assean Lake complex: ancient crust at the northwestern margin of the Superior craton, Manitoba, Canada. *In* Earth's oldest rocks II (Van Kranendonk, M..J., Hoffmann, E. and Bennett, V. Eds.) *Developments in Precambrian Geology*.

2018

Woo, J.M.Y., Brasser, R., Matsumura, S., **Mojzsis**, S.J., Ida, S. (2018) The curious case of Mars' formation. *Astronomy & Astrophysics*. https://doi.org/10.1051/0004-6361/201833148.

Brasser, R., Dauphas, N., **Mojzsis**, S.J. (2018) Jupiter's influence on the building blocks of Mars and Earth *Geophysical Research Letters*, **45**, https://doi.org/10.1029/2018GL078011.

Mojzsis, S.J., Abramov, O., Frank, E.A., Brasser, R., (2018) Thermal consequences to Mercury's mantle by impact bombardment. *Earth and Planetary Science Letters* **482**, 1-9.

******Kelly, N.M., Metcalf, J.R., Flowers, R.M., **Mojzsis**, S.J. (2018) Late accretion to the Moon recorded in (U-Th)/He zircon thermochronometry. *Earth and Planetary Science Letters* **482**, 222-235.

Michalski, J., Onstott, T.C., **Mojzsis**, S.J., Mustard, J., Chan, Q., Niles, P.B., Stewart-Johnson, S. (2018) The martian subsurface as a potential window into the origin of life. Nature Geoscience. https://doi.org/10.1038/s41561-017-0015-2.

2017

Genda, H., Brasser, R., and **Mojzsis**, S.J. (2017) The terrestrial late veneer from core disruption of a lunar-sized impactor. *Earth and Planetary Science Letters* **480**, 25-32.

Brasser, R., **Mojzsis**, S.J. (2017) A colossal impact furnished Mars with a late veneer. *Geophysical Research Letters*, **44**, https://doi.org/10.1002/2017GL074002.

Brasser, R., **Mojzsis**, S.J., Matsumura, S., Ida, S. (2017) The cool and distant formation of Mars. *Earth and Planetary Science Letters* **468:** 85-93.

Frank, E.A., Potter, R.W.K., Abramov, O., James, P.B., Klima P.B., **Mojzsis**, S.J., Nittler, L.R. (2017) Evaluating an impact origin for Mercury's high-magnesium region. *Journal of Geophysical Research – Planets.* 10.1002/2016JE005244

Hynek, B.M., **Mojzsis**, S.J. (2017) The great Mars climate paradox redux. *Geology*. doi:10.1130/ focus102016Y.1.

2016

Caro, G., Morino, P., **Mojzsis**, S.J., Cates, N.L., Bleeker, W. (2016) Sluggish Hadean geodynamics: Evidence from coupled 146,147Sm-142,143Nd systematics in Eoarchean supracrustal rocks of the Inukjuak domain (Québec). *Earth and Planetary Science Letters* **457**:23-37.

Barge, L.M., Branscomb, E., Brucato, J.R., Cardoso, S.S.S., Cartwright, J.H.E., Danielache, S.O., Galante, D., Kee, T.P., Miguel, Y., **Mojzsis**, S.J., Robinson, K.J., Russell, M.J., Simoncini, E., Sobron, P. (2016) Thermodynamics, disequilibrium, evolution: Far-from-equilibrium geological and geochemical considerations for Origin-of-Life Research. *Origins of Life and Evolution of Biospheres* doi: 10.1007/s11084-016-9508-z

Brasser, R., **Mojzsis**, S.J., Werner, S.C., Matsumura, S., Ida, S. (2016) Late veneer and late accretion to the terrestrial planets. *Earth and Planetary Science Letters* **455**:85-93.

Petrash, D.A., Robbins, L.J., Shapiro, R.S., **Mojzsis**, S.J., Konhauser, K.O. (2016) Chemical and textural overprinting of ancient stromatolites: timing, processes, and implications for their use as paleoenvironmental proxies. *Precambrian Research* **278**: 145-160.

Brasser, R., Matsumura, S., Ida, S., **Mojzsis**, S.J., Werner, S.C. (2016) Analysis of terrestrial planet formation by the Grand Tack model: System architecture and tack location. *Astrophysical Journal* **821**:75.

Frank, E.A., Maier, W.D. and **Mojzsis**, S.J. (2016) Highly siderophile element abundances in Eoarchean komatiite and basalt protoliths. *Contributions to Mineralogy and Petrology* **171**: 29

Abramov, O. and **Mojzsis**, S.J. (2016) FRONTIERS PAPER: Thermal effects of impact bombardments on Noachian Mars. *Earth and Planetary Science Letters* **442**, 108-120.

2015

Willbold, M., Elliot, T. and **Mojzsis**, S.J. (2015) The W isotope composition of the Acasta Gneiss Complex (Northwest Territories, Canada). *Earth and Planetary Science Letters.* doi:10.1016/j.epsl.2015.02.040

Hopkins, M.D., **Mojzsis, S.J. (2015) A protracted lunar bombardment (4250-3800 Ma) lunar bombardment from combined mineral chemistry, Ti-thermometry and U-Pb zircon geochronology of Apollo 14 melt breccia zircons. *Contributions to Mineralogy and Petrology* **169**:30 DOI 10.1007/s00410-015-1123-x.

Polgári, M., Németh, T., Pál-Molnár, E., Futó, I., Vigh, T. and Mojzsis, S.J. (2016) Correlated chemostratigraphy of manganese-carbonate microbialites (Úrkút, Hungary). *Gondwana Research* 29: 278-289.

Hopkins, M.D., **Mojzsis**, S.J. Bottke, W.F. and Abramov, O. (2015) Micrometer-scale U- Pb age domains in eucrite zircons, impact re-setting and the thermal history of the HED parent body. Icarus. 245, 367-378.

2014

Frank, E.A., Meyer, B. and **Mojzsis, S.J. (2014) A radiogenic heating model for cosmochemically Earth-like exoplanets. *Icarus* **243**, 274-286.

Roth, A.S.G., Bourdon, B., **Mojzsis**, S.J., Rudge, J.F., Guitreau, M. and Blichert-Toft, J. (2014) Combined ^{147,146}Sm-^{143,142}Nd constraints on the longevity and residence time of early terrestrial crust. *Geochemistry, Geophysics, Geosystems* DOI 10.1002/2014GC005313.

Guitreau, M., Blichert-Toft, J., **Mojzsis**, S.J., Roth, A.S.G., Bourdon, B., Cates, N.L. and Bleeker, W. (2014) The Lu-Hf isotope system in the Acasta Gneiss Complex (Northwest Territories, Canada) *Geochimica et Cosmochimica Acta* **135**, 251-269.

Mojzsis, S.J., Cates, N.L., Bleeker, W., Hopkins, M.D., Guitreau, M., Blichert-Toft, J., Trail, D. and Abramov, O. (2014) Component geochronology of the ca. 3920 Ma Acasta Gneiss. *Geochimica et Cosmochimica Acta* **133**, 68-96.

Swanner, E.D., Planavsky, N.J., Lalonde, S.V., Robbins, L.J., Bekker, A., Rouxel, O.J., Kappler, A., **Mojzsis, S.J. and Konhauser, K.O. (2014) Cobalt and marine redox evolution. *Earth and Planetary Science Letters* **390**, 253-263.

2013

Swanner, E.D., Cates, N.L., Pecoits, E., Bekker, A., Konhauser, K.O. and **Mojzsis**, S.J. (2013) Geochemistry of pyrite from diamictites of the Boolgeeda Iron Formation, Western Australia with implications for the GOE and Paleoproterozoic ice ages. *Chemical Geology* **362**, 131-142.

Abramov, O., Kring, D.A., and **Mojzsis**, S.J. (2013) INVITED REVIEW: The impact environment of the Hadean Earth. *Chemie der Erde-geochemistry* **73**: 227-248.

Mloszewska, A.M., **Mojzsis**, S.J., Pecoits, E., Papineau, D., Dauphas, N. and Konhauser, K.O. (2013) Chemical sedimentary protoliths of the >3.75 Ga Nuvvuagittuq Supracrustal Belt (Quebec, Canada). *Gondwana Research* **23**, 574-594.

Guitreau, M., Blichert-Toft, J., **Mojzsis**, S.J., Roth, A.S.G. and Bourdon, B. (2013) A legacy of Hadean silicate differentiation inferred from Hf isotopes in Eoarchean rocks of the Nuvvuagittuq supracrustal belt (Quebec, Canada). *Earth Planet. Sci. Lett.* **362**, 171-181.

Roth, A.S.G., Bourdon, B., **Mojzsis**, S.J., Touboul, M., Sprung, P., Guitreau, M. and Blichert-Toft, J. (2013) Inherited ^{142}Nd anomalies in Eoarchean protoliths. *Earth Planet. Sci. Lett.* **361**, 50-57.

Cates, N.L., **Mojzsis, S.J., Ziegler, K. and Schmitt, A.K. (2013) Reduced, reused and recycled: Detrital zircons define a maximum age for the Eoarchean (ca. 3750-3780 Ma) Nuvvuagittuq supracrustal belt, Québec (Canada) *Earth. Planet. Sci. Lett.* **362**, 283-293.

2012

Mloszewska, A.M., Pecoits, E., Cates, N.L., **Mojzsis**, S.J., O'Neil, J., Robbins, L.J. and Konhauser, K.O. (2012) The composition of Earth oldest iron formations: The Nuvvuagittuq Supracrustal Belt (Quebec, Canada). *Earth and Planetary Science Letters* **317**, 331-342.

Abbott, S.S., Harrison, T.M., Schmitt, A.K. and **Mojzsis**, S.J. (2012) A search for thermal excursions from ancient extraterrestrial impacts using Hadean zircon Ti-U-Th-Pb depth profiles. *Proc. Nat. Acad. Sci.* **109**, 13486-13492.

Guitreau, M. Blichert-Toft, J., Martin, H., **Mojzsis**, S.J. and Albarède, F. (2012) Hafnium isotope evidence from Archean granitic rocks for deep-mantle origin of continental crust. *Earth and Planetary Science Letters* **337-338**, 211-223.

Maier, A.C., Cates, N.L., Trail, D. and **Mojzsis**, S.J. (2012) Geology, age and field relations of Hadean zircon-bearing supracrustal rocks from Quad Creek, eastern Beartooth Mountains (Montana and Wyoming, USA). *Chemical Geology* **312**, 47-57.

2011

Konhauser, K.O., Lalonde, S.V., Planavsky, N., Pecoits, E., Lyons, T.W., **Mojzsis**, S.J., Rouxel, O.J., Barley, M.E., Rosiere, C., Fralick, P.W., Kump, L.R. and Bekker, A. (2011). Aerobic bacterial pyrite oxidation and acid rock drainage during the Great Oxidation Event. *Nature* **478**, 369-373.

Abramov, O. and **Mojzsis**, S.J. (2011) Abodes for life in carbonaceous asteroids? *Icarus* **213**, 273-279.

2010

Papineau, D., DeGregorio, B.T., Cody, G.D., Fries, M.D., **Mojzsis**, S.J., Steele, A., Stroude, R.M. and Fogel, M.L. (2010) Ancient graphite in Eoarchean quartz-pyroxene rocks from Akilia, West Greenland I: Petrographic and spectroscopic characterization. *Geochimica et Cosmochimica Acta* **74**, 5862-5883.

2009

Abramov, O. and **Mojzsis**, S.J. (2009) Microbial habitability of the terrestrial biosphere during the late heavy bombardment. *Nature* **459**, 419-422.

Cates, N.L. and **Mojzsis**, S.J. (2009) Metamorphic zircon, trace elements and Neoarchean metamorphism in the ca. 3.75 Ga Nuvvuagittuq supracrustal belt, Québec (Canada). *Chemical Geology* **261**, 98-113.

2008

Caro, G., Bennett, V.C., Bourdon, B., Harrison, T.M., **Mojzsis**, S.J. and Harris, J.W. (2008) Precise analysis of $^{142}Nd/^{144}Nd$ in small samples: Application to Hadean zircons from Jack Hills (W. Australia) and diamond inclusions from Finsch (S. Africa). *Chemical Geology* **247**, 253-265.

2007

***Mojzsis**, S.J. (2007) Sulphur on the Early Earth. *In*, Earth's oldest rocks (Van Kranendonk, M..J., Smithies, R.H. and Bennett, V. Eds.) Developments in Precambrian Geology **15**, 923-970.

Papineau, D., **Mojzsis**, S.J. and Schmitt, A.K. (2007) Multiple sulfur isotopes from Paleoproterozoic Huronian interglacial sediments and the rise of atmospheric oxygen. *Earth and Planetary Science Letters* **255**, 188-212.

Turner, G., Busfield, A., Crowther, S., Harrison, T.M., **Mojzsis**, S.J. and Gilmour, J. (2007) Pu-Xe, U-Xe, U-Pb chronology and isotope systematics of ancient zircons from Western Australia. *Earth and Planetary Science Letters* **261**, 491-499.

Trail, D., **Mojzsis**, S.J. and Harrison, T.M. (2007) Thermal events documented in Hadean zircons by ion microprobe depth profiles. *Geochimica et Cosmochimica Acta* **71**, 4044-4065.

Trail, D., **Mojzsis**, S.J., Harrison, T.M., Schmitt, A.K., Watson, E.B. and Young, E.D. (2007) Constraints on Hadean protoliths from oxygen isotopes and Ti-thermometry *Geochemistry, Geophysics, Geosystems* **8**. doi:10.1029/2006GC001449.

Cates, N.L. and **Mojzsis**, S.J. (2007) Pre-3750 Myr supracrustal rocks from the Nuvvuagittuq Belt (Porpoise Cove), northern Québec. *Earth and Planetary Science Letters* **255**, 9-21.

Dauphas, N., Cates, N.L., **Mojzsis**, S.J. and Busigny, V. (2007) Recognition of sedimentary protoliths with iron isotopes in the >3.76 Ga Nuvvuagituk supracrustal belt, Canada. *Earth and Planetary Science Letters* **254**, 358-376.

2006

Cates, N.L. and **Mojzsis**, S.J. (2006) Chemical and isotopic evidence for widespread Eoarchean (≥3750 Ma) metasedimentary enclaves in southern West Greenland. *Geochim. Cosmochim. Acta* **70**, 4229-4257.

Manning, C.E., **Mojzsis**, S.J. and Harrison, T.M. (2006) Geology and age of supracrustal rocks, Akilia, Greenland *Amer. J. Sci.* **306**, 303-366.

Papineau, D. and **Mojzsis**, S.J. (2006) Mass-independent fractionation of sulfur isotopes in sulfides from the pre-3770 Ma Isua Supracrustal Belt, West Greenland. *Geobiology* **4**, 227-238.

2005

Papineau, D., **Mojzsis**, S.J., Coath, C.D., Karhu, J.A. and McKeegan, K.D. (2005) Multiple sulfur isotopes of sulfides from sediments in the aftermath of Paleoproterozoic glaciations *Geochim. Cosmochim. Acta* **69**, 5033-5060 (doi: 10.1016/j.gca.2005.07.005).

Papineau, D., Walker, J.J., **Mojzsis**, S.J. and Pace, N.R. (2005) Composition and structure of microbial communities from stromatolites of Hamelin Pool in Shark Bay, Western Australia *Appl. Environ. Microbio*. **71**, 4822-4832 (doi: 10.1128/AEM.71.8.4822-4832.2005).

Papineau, D., **Mojzsis**, S.J., Karhu, J.A. and Marty, B. (2005) Nitrogen isotopic composition of ammoniated phyllosilicates: Case studies from Precambrian metamorphosed sedimentary rocks *Chem. Geol.* **216**, 37-58 (doi: 10.1016/j.chemgeo.2004.10.009).

Harrison, T.M., Blichert-Toft, J., Müller, W., Albarède, F., Holden, P. and **Mojzsis**, S.J. (2005) Response to comment: Heterogeneous Hadean Hafnium: Evidence of continental crust at 4.4 to 4.5 Ga *Science* **312**, 1139b.

Harrison, T.M., Blichert-Toft, J., Müller, W., Albarède, F., Holden, P. and **Mojzsis**, S.J. (2005) Heterogeneous Hadean Hafnium: Evidence of continental crust at 4.4 to 4.5 Ga *Science* **310**, 1947-1950.

2004

Turner, G., Harrison, T.M., Holland, G., **Mojzsis**, S.J. and Gilmour, J. (2004) Extinct ^{244}Pu in ancient zircons: *Science* **306**, 89-91.

2003

Mojzsis, S.J., Coath, C.D., Greenwood, J.P., McKeegan, K.D. and Harrison, T.M. (2003) Confirmation of mass-independent isotope effects in Archean (2.5 – 3.8 Ga) sedimentary sulfides as determined by ion microprobe analysis: *Geochim. Cosmochim. Acta* **67**(9), 1635-1658.

Mojzsis, S.J., Devaraju, T.C. and Newton, R.C. (2003) Ion microprobe U-Pb age determinations on zircon from the Late Archean granulite facies transition zone of southern Karnataka, India: *J. Geol.* **111**, 407-425.

2002

Mojzsis, S.J., and Harrison, T.M. (2002) Establishment of a 3.83 Ga magmatic age for the Akilia tonalite (southern West Greenland). *Earth Planet. Sci. Lett.* **202**, 563-576.

Mojzsis, S.J. and Harrison, T.M. (2002) Origin and Significance of Archean Quartzose Rocks at Akilia, Greenland: *Science* **298**, 917a.

2001

Mojzsis, S.J., Harrison, T.M., Pidgeon, R.T., C.D. (2001) Oxygen isotope evidence from ancient zircons for liquid water at Earth's surface 4,300 Myr ago: *Nature* **409**, 178-181.

Anbar, A.D., Zahnle, K.J. and **Mojzsis**, S.J. (2001) Extraterrestrial iridium, sediment accumulation and the habitability of the early Earth's surface: *J. Geophys. Res.* **106(2)**, 3219-3236.

Mojzsis, S.J., and Ryder, G. (2001) Extraterrestrial accretion to the Earth and Moon ca. 3.85 Ga, In: *Accretion of Extraterrestrial Matter Throughout Earth History*, edited by B. Peuckner-Ehrenbrink and B. Schmitz: Kluwer, pp. 423-446.

2000

Mojzsis, S.J., and Harrison, T.M. (2000) Vestiges of a beginning: clues to the emergent biosphere recorded in the oldest known sedimentary rocks: *GSA Today* **10**: 1-6.

Ryder, G., Koeberl, C., and **Mojzsis**, S.J. (2000) Heavy bombardment of the Earth at ~3.85 Ga: The search for petrographic and geochemical evidence, In: *Origin of the Earth and Moon*; edited by K. Righter and R. Canup: University of Arizona Press pp.475-492.

Greenwood, J.P., **Mojzsis**, S.J. and Coath, C.D. (2000) Sulfur isotopic compositions of individual sulfides in ALH84001 and Nakhla: implications for crust-regolith exchange on Mars: *Earth Planet. Sci. Lett.* **184**, 23-25.

1999

Mojzsis, S.J., Krishnamurthy, R., and Arrhenius, G. (1999) Before RNA and After: Geophysical and geochemical constraints on molecular evolution, In: *The RNA World II*, edited by Gesteland, R., Cech, T. and Atkins, J.: Cold Spring Harbor Press, New York pp. 1- 47.

Mojzsis, S.J., Harrison, T.M., Arrhenius, G., McKeegan, K.D., and Grove, M. (1999) Origin of life from apatite dating? – Reply: *Nature* **400**, 127-128.

1998

Mojzsis, S.J., and Arrhenius, G. (1998) Phosphates and carbon on Mars: Exobiological implications and sample return considerations: *J. Geophys. Res.* **103**(E12), 28,495-28,511.

1997

Nutman, A.P., **Mojzsis**, S.J., and Friend, C.R.L. (1997) Identification of the oldest water-lain sediments at >3850 Ma from Akilia island, southern West Greenland: *Geochim. Cosmochim. Acta* **61**(12), 2475-2484.

Arrhenius, G., Sales, B., **Mojzsis**, S.J., and Lee, T. (1997) Entropy and charge in molecular evolution: the role of phosphate: *J. Theor. Bio.* **187**, 503-522.

Eiler, J.M., **Mojzsis**, S.J., and Arrhenius, G. (1997) Carbon isotope evidence for early life: *Nature* **386**, 665.

1996

Mojzsis, S.J., Arrhenius, G., McKeegan, K.D., Harrison, T.M., Nutman, A.P., and Friend, C.R.L. (1996) Evidence for life on Earth by 3800 million years ago. *Nature* 384 (6604), 55-59.

Arrhenius, G., and **Mojzsis**, S.J. (1996) Life on Mars – then and now: *Curr. Bio.* **6**(10), 1213-1216.

1993

*Arrhenius, G., Gedulin, B., and **Mojzsis**, S.J. (1993) Phosphate in models for chemical evolution, In: *Chemical Evolution: Origin of Life*, edited by Ponnamperuma, C., and Chela-Flores, J.: A. Deepak, Hampton, Virginia, pp. 25-50.

OTHER PUBLICATIONS

Mojzsis, S.J. (2011) Earth, formation and early evolution. *Encyclopedia of Astrobiology.*

Mojzsis, S.J. (2010) Leftover lithosphere. *Nature Geosciences* **3**, 148-149. [N&V]

Mojzsis, S.J. (2007) Early Earth Systems: A geochemical approach: *Elements* (August, 2007 issue) [Book review].

Mojzsis, S.J. (2005) Precambrian hydrocarbons: Products of changing geology and biology with time. *Petrol. Front.* **20**, 3-10.

Mojzsis, S.J. (2005) Atmosphere evolution, In *Encyclopedia of Geology*, edited by R. Selley, R. Cocks and I.R Plimer: Elsevier, Oxford **1**, 197-207.

Mojzsis, S.J. (2004) The First Billion Years: New insights from geochemistry: *Precambrian Research* **135** (4), 245-250. [preface to a special issue for which I was guest editor]

Mojzsis, S.J. (2004) Life in the first billion years: *Journal of High School Science (Canada)* **3** (1), 46-51. [public service/outreach activity]

Mojzsis, S.J. (2003) The Early Earth: Physical, Chemical and Biological Development: *Eos – Trans. Amer. Geophys. Union* **88** (36), 358. [Book review]

Mojzsis, S.J. (2003) Probing early atmospheres: *Nature* **425** (6955), 249-251 doi:10.1038/425249a. [N&V]

Mojzsis, S.J. (2002) Origin of Life: The First Fossils, In *Encyclopedia of Evolution*, edited by M. Pagel: Oxford University Press, Oxford, pp. 843-845.

Mojzsis, S.J. (2001) Life and the evolution of Earth's atmosphere, In *Earth – inside and out*, edited by E. Mathez: New Press, New York, pp. 32-39.

PRESENT RESEARCH ASSOCIATE, POSTDOCTORAL AND STUDENT SUPPORT

Current Research Associates (Research Faculty)

Dr. Ramon Brasser	Visiting Associate Research Professor from ELSI-TiTech
Dr. Nigel Kelly	Associate Research Professor from CSM & Bruker Nanoanalytics
Dr. Oleg Abramov	Visiting Associate Research Professor from PSI

Current Graduate students

Michael Zawaski	Ph.D. student (since 2016) supported by the GEOL department
Patrick Morrison	Ph.D. student (since 2018) supported by the EBIO department
Amanda Alexander	Ph.D. student (since 2019) supported by SwRI

GRADUATE STUDENT SUPERVISED & CO-SUPERVISED – COMPLETED

Papineau, Dominic (Ph.D. graduated April 2006) "The rise of atmospheric oxygen and the evolution of the sulfur and nitrogen cycles on the Archean and Proterozoic Earth". *Prof. Papineau is now a University Lecturer at the University College of London, UK.*

Cates, Nicole (Ph.D. graduated July 2009) "Geology age and origin of Eoarchean rocks from the Itsaq Gneiss Complex (West Greenland) and the Nuvvuagituq Belt (northern Québec)". *Dr. Cates is now a Lecturer at the University of Manitoba, Winnipeg (Canada).*

Swanner-Smith, Elizabeth (Ph.D. graduated July 2010). *Prof. Swanner is now an assistant professor at Iowa State University. I co-advised her with A. Templeton*

Trail, Dustin (M.A. graduated July 2006) "Geochemical and thermal history of pre-4 Ga zircons from Western Australia." *Prof. Trail is now an Associate Professor of Geochemistry at the University of Rochester, and Visiting Associate Professor of Geochemistry at UCLA.*

Glaser, Steven (M.A. graduated June 2011)"Trace elements in stromatolitic sulfides through time record changes in microbial community structure". *Mr. Glaser is now a graduate student with E. Shock at ASU.*

Maier, Analisa (M.A. graduated June 2012) "Geology, age and origin of the Beartooth Mountain Quartzite (southern Montana)" *Mrs. Bermel (née Maier) is now a staff geologist with Apache Oil & Gas Corporation.*

Hopkins, Michelle (Ph.D. graduated June 2014). *"Investigating the bombardments on the Moon and Asteroid Belt from the thermal response of zircon". Dr. Hopkins is now an adjunct researcher at the University of Alabama.*

Frank, Elizabeth (Ph.D. graduated September 2014). *"Habitability of Earth-like worlds in the cosmos Dr. Frank was a MESSENGER postdoctoral fellow at the Department of Terrestrial Magnetism, Carnegie Institution of Washington. Dr. Frank is now a chief scientist at Planetary Resources in Seattle.*

Greer, Jennika (M.A. graduated May 2016). “Multiple generations of Archean granitoid gneisses hosting supracrustal enclaves in the southern Inukjuak domain, Québec (Canada)”. *Ms. Greer is now an NSF graduate Ph.D. fellow at the University of Chicago with Phillip Heck.*

Oulton, Jonathan (M.A. graduated May 2017). "The enigma of extraterrestrial granites.” *Mr. Oulton now works for the American Alpine Club and Scarpa Inc in Boulder, Colorado.*

Schug, Line (M.Sc. graduated May 2017 from University of Weinegigen, Netherlands). “Petrographic domains in martian meteorite NWA7034”. *Ms. Schug will be entering a Ph.D. program in Fall 2020.*

POSTDOCTORAL SCHOLARS SUPERVISED - COMPLETED

Oleg Abramov	National Research Council (2007-2010) *now at PSI*
Nicole L. Cates	NASA Lunar Science Institute (2008-2014) *now at Manitoba*
Nigel M. Kelly	NASA Cosmochemistry & Templeton Foundation (2014-2018) *now at Bruker*
Leilani Arthurs	Science Education Initiative (2007-2009) *now Asst. Prof. at CU Boulder*
Andrea Bair	Science Education Initiative (2006-2010) *now at Central Michigan University*
Jennifer Stempien	Science Education Initiative (2006-2009) *now Senior Lecturer at CU Boulder*

GRADUATE STUDENT THESIS COMMITTEES – EXTERNAL COMMITTEE MEMBER

Black, Sarah (graduated Spring 2018) Geological Sciences (Postdoctoral at SwRI)

Hara, Ellie (arrived August 2017) Geological Sciences

Miller, Hannah (graduated Spring 2017) Geological Sciences (Hydrogeochemist)

Haughsjaa-Hughes, Anna (graduated 2011) Astrophysics and Planetary Sciences

Holl, Christopher Ph.D. (graduated 2006) Geological Sciences (now at Northwestern University)

Knowles, Emily (graduated 2012) Geological Sciences (Postdoctoral scholar at NASA-JPL)

Putzig, Nathaniel Ph.D. (graduated 2006) Astrophysics and Planetary Sciences (now at SwRI)

Mayhew, Lisa (graduated 2012) Geological Sciences (Research Associate at CU)

Wolf, Eric (graduated, Spring 2014) Atmospheric and Ocean Sciences (Researcher at LASP)

UNDERGRADUATE HONORS THESES

Singer, Kelsi N. B.A. (graduated 2006) ”Cyclic Rhythmites: Quantitative record of the ancient Earth-Moon system” latin honors: *magna cum laude* (now a research associate at the Southwest Research Institute, Boulder).

Greer, Jennika B.A. (graduated 2013) “Paleoarchean – Mesoarchean assembly of the Inukjuak terrane, northern Quebec” latin honors: *summa cum laude*. (now at the University of Chicago with Philip Heck).

Warren, Nicholas. B.A. (graduated 2016) “Stromatolites of the Lykins Formation, Colorado”: latin honors: *cum laude*

Martins-Pimentel, Rayssa. B.A. (graduated 2018) “Geochronology of the Santa Fe Impact Structure, northern New Mexico”: Latin honors: *summa cum laude.* (now at IPG-Paris with Fred Moynier).

Alexander, Amanda. B.A. (will graduate 2018) "Mars' late veneer impactor" Latin Honors: *Magna cum laude.* (now a research associate at the Southwest Research Institute, Boulder).

RECORD OF UNDERGRADUATE MENTORSHIP

Jon Adam	M.Ed. graduate in Science Education
Amanda Alexander	B.A. student in Astronomy
John Braswell	B.Sc. student in Geology (University of Michigan), UNAVCO intern 2009
Laurie Carmack	B.A. graduate in Anthropology
Jennika Greer	B.A. student in Astrophysics & Geology
Michael Gross	B.A. student in Chemistry & Geology
Jeffrey Jennings	B.A. student in Astrophysics
Wilder Lavington	B.A. student in Applied Mathematics
Analisa Maier	B.A. student in Geology
Rayssa Martins	B.A. student in Geology & Astronomy
Cole Pozar	B.A. student in Geology
Diana C. Prado	B.Sc. student in Geology (University of Puerto Rico), UNAVCO intern 2010
Katie Quinn	B.A. student in Geology and Astronomy
Heather Sickels	B.A. graduate in Biology and Geological Sciences
Samuel Simon	B.A. student in Geology
Kelsi Singer	B.A. graduate in Astrophysics
Nick Strohecker	B.A. graduate in Accounting
Dustin Trail	B.A. graduate in Computer Science
Nicholas Warren	B.A. student in Geological Sciences and Business

CURRICULUM DEVELOPMENT

I have developed or re-created 20 new courses, seminars and field courses since I arrived at the University of Colorado in early 2001. During this time, the new graduate (3 cr.) level courses I developed were: Critical Thinking: Early Earth/Origin of Life, Cosmochemistry, The Moon, Geobiology, Archean/Proterozoic Geology, and Late Accretion. In Fall 2013 I reformed the graduate level (3 cr.) Planetary Surface and Interiors course. Graduate seminars (1 cr.) that I have created are: Planetary Habitability, Planetary Diversity, and Planetary Water, as well as four of the 2 cr. Planetary Field Geology courses (Death Valley/Mojave; Northern Arizona/New Mexico; Yellowstone; Iceland). Furthermore, I created or re-created a number of 3 cr. undergraduate classes: Historical Geology class and Earth System History, Extraterrestrial Life, and the Search for Life in the Universe. I also offer the Introduction to Planetary Field Geology (2 cr.) and Introduction to Cosmochemistry (3 cr.) to our undergraduates.

I regularly update my course curricula with updates of the lecture notes and presentations into a permanent Powerpoint collections of lectures, model simulations, as well as pdf documents of homeworks, quizzes, exams and handouts; these are all stored in the CU Boulder Data Repository and in hard disks. These pedagogical resources are available at request to other faculty worldwide on my website (isotope.colorado.edu) under "courses". I have consistently improved the curriculum of all my courses to better match students' needs, which I believe is reflected in my increasingly favorable student scores over the years as well as a University of Colorado Residence Life Teaching Award in 2004, and the University of Colorado's ASSETT Award for Excellence in Teaching in 2014. In the time I have been at CU, I

calculated that approximately 4000 students have passed through my classrooms and I have accumulated about 7500 Student Credit Hours. I use D2L, CANVAS and personal response devises (iClickers).

Described below are the courses I have developed and taught in the undergraduate and graduate programs of Geological Sciences at the University of Colorado that I would bring with me.

GEOL 1010 Introduction to Geology 1 – Physical Geology (3 credit lecture). It reviews the physical and chemical structure of Earth materials, mineralogy, geophysics and fluid processes in the Earth and at the surface. Lower division undergraduate.

GEOL 1020 Introduction to Geology 2 – Earth System History (3 credit lecture). This introductory course builds on knowledge of physical geology with a more biogeochemical perspective. It is meant to tie the different pieces of evidence for the evolution of the geosphere and biosphere together into a coherent whole so that beginning students in the earth sciences can recognize the inter-connectedness of geology with chemistry and physics. Lower division undergraduate.

GEOL/ASTR 2040 Life in the Universe (3 credit lecture). A re-organization of the previous GEOL/ASTR 3300 course for a lower-division cohort.

GEOL/ASTR 3300 Extraterrestrial Life (3 credit lecture). Explores the scientific basis for the possible existence of extraterrestrial life by reviewing the origin and evolution of life on Earth. The geologic record is treated as the natural baseline for understanding the possibility for life to have emerged elsewhere in the solar system and beyond the solar system. We also explore societal issues concerning the origin of life as well as the philosophical basis for looking for other life in the Universe. Upper division undergraduate level.

GEOL 4500 Critical Thinking in the Earth Sciences: Early Earth/ Origin of Life (3 credit lecture). Students read, analyze and present material in a seminar format that explores what is known about conditions on the early Earth's surface at the time of the emergence of life. The time period explored in this course follows from planetary accretion to the establishment of a permanent oxygenated atmosphere. Students probe controversies and discuss scientific issues in the interpretation of Earth's early geological and biological history. Upper division undergraduate and beginning graduate level.

GEOL 4700/5700_001 Introduction to Archean & Proterozoic Geology (3 credit lecture). Explores the character of Precambrian geology and geochemistry and associated igneous, metamorphic and sedimentary assemblages. We contrast the observations of the Earth from Precambrian geology with that seen in the Phanerozoic of North America and elsewhere. The economic importance of Precambrian studies as well as its central role in understanding the emergence and evolution of the biosphere is emphasized. Reading lists will be prepared in advance, with student-led discussion and final paper preparation and presentation. Undergraduate and Graduate level.

GEOL 4350 Introduction to Planetary Field Geology (2 credit field course). The course provides students with an introduction to the techniques used to "ground-truth" data returned from space missions to planetary surfaces (e.g. Mars) to actual examples in a geologic field context. The course takes the form of 2-3 overview lectures, followed by a 1week camping excursion (self-catering) to relevant field study sites that extend from southern Wyoming (Laramides; Snowy Pass Group), to central (Lykins Fm; P-Tr boundary stromatolites) and southern Colorado (K-Pg boundary; Florrisant fossil beds; Great Sand Dunes) and finishing up in northern New Mexico (Rio Grande Rift; Santa Fe impact structure). Field presentations by the students are coupled with practical experience and introductory material on the regional geology of each locale. Undergraduate level.

GEOL 4330/5330 Cosmochemistry (3 credit lecture and laboratory). This course explains the origin, history and transformation of matter in the solar system including the biologically important elements. We survey the various forms in which this matter occurs as primitive bodies (meteorites, comets), planets and stars and then focus on the history of that matter. Explains basic concepts of nucleosynthesis (the origin of elements) and devotes this knowledge to the chemistry and mineralogy of the planets and meteorites. Since I teach this material under the auspices of Geological Sciences, the majority of this course is therefore devoted to traditional geological topics. For astronomy students, it should be a useful introduction to concepts of geology. For geology students, it will be a new application of their knowledge towards astrophysical phenomena. For other advanced students of the physical sciences and engineering, it provides a springboard to a whole new field. Both upper division undergraduate & Graduate level sections are offered. At the present time, I teach the courses *separately* so that the graduate and undergraduate courses are offered alternate years.

GEOL 5350 Planetary Field Geology (2 credit field course). This is a field course in geological methods of interest to planetary scientists. Over a five-year span, I lead trips to Death Valley, northern Arizona, eastern Utah, Yellowstone and Hawai'i.

GEOL 5700 Geobiology (3 credit lecture). A course that explores the co-evolution of the biosphere with the geosphere and atmosphere, and contemporary examples of mineral-microbe interactions in the crust and hydrosphere. Graduate level.

GEOL/ASTR 5830 Special Topics in Planetary Science: Late Accretion (3 credit lecture). This course reviews the dynamical, geophysical, geochronological and geochemical basis for our current understanding of the nature of post-primary accretion of the planets, with special emphasis on the sampled inner solar system. Graduate level.

GEOL/ASTR 5830 Special Topics in Planetary Science: Geology, Age and Origin of the Moon (3 credit lecture). In this course we explore the geology, age and origin of the Moon with a mixture of topical lectures and guest lecturers from experts in the field of lunar science. Graduate level.

GEOL/ASTR 5835 Planetary Habitability (1 credit seminar). This course explores the criteria used to describe a "Habitable Planet" and critically analyzes the assumption used in the search for Earth-like worlds by remote methods. Graduate level.

GEOL/ASTR 5835 Planetary Water (1 credit seminar). This seminar reviewed the evidence for the role of water in past and present solar system objects. Graduate level.

GEOL/ASTR 5835 Planetary Diversity (1 credit seminar). This seminar examines the evidence for the diverse origins of the planetary building blocks, and what this means for exoplanets. Graduate level.

GEOL/ASTR 5800 Planetary Surfaces and Interiors (3 credit lecture). Examines the processes operating on the surfaces of solid planets and their interiors. Emphasizes spacecraft observations, their interpretation, the relationship to similar processes on Earth, the relationship between planetary surfaces and interiors, and the integrated geologic histories of the terrestrial planets and satellites. Graduate level.