

DAMANVEER S. GREWAL

Division of Geological and Planetary Sciences, California Institute of Technology,
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EDUCATION

- 2016-2021 **PhD (Experimental Cosmochemistry/Planetary Science)**
Rice University, Houston, USA
Origin of nitrogen and carbon in the rocky bodies of the inner Solar System
- 2007-2012 **Integrated BSc+MSc (Applied Geology)**
Indian Institute of Technology (IIT), Kharagpur, India

PROFESSIONAL APPOINTMENTS

- 2022-Present Barr Foundation Postdoctoral Fellow, California Institute of Technology, Pasadena, USA
- 2016-21 Research Assistant, Rice University, Houston, USA
- 2014-16 Chemistry Teacher, Lakshya Forum for Competitions Pvt. Ltd., Patiala, India
- 2012-14 Chemistry Teacher, iQuest Eduventures, Patiala, India
- 2010 Research Intern, Christian-Albrechts-Universität zu Kiel, Germany

GRANTS, FELLOWSHIPS, AND AWARDS

- 2022 Caltech Center for Comparative Planetary Evolution (\$8,800)
- 2022 Caltech Center for Comparative Planetary Evolution and the Caltech Microanalysis Center Research Grant (\$21,000)
- 2022 Travel grant Planet Formation for Planet Formation Workshop by Munich Institute of Astro- and Particle Physics *declined*
- 2022 Outstanding Student Presentation Award, AGU 2021 (\$250)
- 2021 Barr Foundation Postdoctoral Fellowship, California Institute of Technology (\$136,500)
- 2021 Alexander von Humboldt Postdoctoral Fellowship (€73,680) *deferred*
- 2021 SESE Exploration Postdoctoral Fellowship, Arizona State University (\$247,000) *declined*
- 2021 Outstanding Graduate Student Award, Rice University (\$2000)
- 2021 Goldschmidt Registration Grant
- 2020 Travel grant Planet Formation for Planet Formation Workshop by Munich Institute of Astro- and Particle Physics *cancelled due to COVID-19*
- 2019 Future Investigators in NASA Earth and Space Science and Technology (FINNEST) (\$90,000)
- 2019 Lodieska Stockbridge Vaughn Fellowship, Rice University (\$16,750)
- 2019 Torkild Rieber Award in Geology, Rice University (\$2000)
- 2019 Goldschmidt Travel Grant (\$1000)
- 2018 Goldschmidt Travel Grant (\$1800)
- 2015 Award for teaching excellence, Lakshya Forum for Competitions
- 2014 Best teacher, iQuest Eduventures
- 2013 Best teacher, iQuest Eduventures
- 2007-12 Innovation in Science Pursuit for Inspired Research, Department of Science and Technology, India

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PEER-REVIEWED ARTICLES

Published

(# designates supervised undergraduate/high school students)

11. **Grewal, D.S.**, Seales, J., Dasgupta, R. (2022) Internal or external magma oceans in the earliest protoplanets – perspectives from nitrogen and carbon fractionation. *Earth and Planetary Science Letters* **598**: 117847. doi: [10.1016/j.epsl.2022.117847](https://doi.org/10.1016/j.epsl.2022.117847)
10. **Grewal, D.S.** (2022) Origin of nitrogen isotopic variations in the rocky bodies of the Solar System. *The Astrophysical Journal* **937**: 123. doi: [10.3847/1538-4357/ac8eb4](https://doi.org/10.3847/1538-4357/ac8eb4)
9. **Grewal, D.S.**, Dasgupta, R., Aithala, S.# (2021) The effect of carbon concentration on its core-mantle partitioning behavior in inner Solar System rocky bodies. *Earth and Planetary Science Letters* **571**: 117090. doi: [10.1016/j.epsl.2021.117090](https://doi.org/10.1016/j.epsl.2021.117090)
8. **Grewal, D.S.**, Dasgupta, R., Hough T.#, Farnell, A.# (2021) Rates of protoplanetary accretion and differentiation set nitrogen budget of rocky planets. *Nature Geoscience* **14**: 369-376. doi: [10.1038/s41561-021-00733-0](https://doi.org/10.1038/s41561-021-00733-0)
7. **Grewal, D.S.**, Dasgupta, R., Marty, B. (2021) A very early origin of nitrogen in inner Solar System protoplanets. *Nature Astronomy* **5**: 356-364. doi: [10.1038/s41550-020-01283-y](https://doi.org/10.1038/s41550-020-01283-y)
6. **Grewal, D.S.**, Dasgupta, R., Farnell, A.# (2020) The speciation of carbon, nitrogen, and water in magma oceans and its effect on volatile partitioning between major reservoirs of the Solar System rocky bodies. *Geochimica et Cosmochimica Acta* **280**: 281-301. doi: [10.1016/j.gca.2020.04.023](https://doi.org/10.1016/j.gca.2020.04.023)
5. Dasgupta, R., **Grewal, D.S.** (2019). Origin and Early Differentiation of Carbon and Associated Life-Essential Volatile Elements on Earth. In Orcutt, B., Daniel, I., Dasgupta, R. (Eds.) *Deep Carbon: Past to Present* (Cambridge University Press). 4-39. doi: [10.1017/9781108677950.002](https://doi.org/10.1017/9781108677950.002)
4. Hakim, K., Spaargaren, R., **Grewal D.S.**, Rohrbach A., Brendt J., Dominik, C., van Westrenen, W. (2019) A laboratory approach to probe the mineralogy of carbon-rich rocky exoplanets. *Astrobiology* **9**: Number 7. doi: [10.1089/ast.2018.1930](https://doi.org/10.1089/ast.2018.1930)
3. **Grewal, D.S.**, Dasgupta, R., Holmes, A.K.#, Costin, G, Li Y., Tsuno K. (2019) The fate of nitrogen during core-mantle separation on Earth. *Geochimica et Cosmochimica Acta* **251**: 87-115. doi: [10.1016/j.gca.2019.02.009](https://doi.org/10.1016/j.gca.2019.02.009)
2. **Grewal, D.S.**, Dasgupta, R., Sun, C., Tsuno K., Costin, G. (2019) Delivery of Carbon, Nitrogen and Sulfur to the Silicate Earth. *Science Advances* **5**: eaau3669. doi: [10.1126/sciadv.aau3669](https://doi.org/10.1126/sciadv.aau3669)
1. Tsuno, K., **Grewal, D.S.**, Dasgupta, R. (2018). Core-mantle fractionation of carbon in Earth and Mars: The effects of sulfur. *Geochimica et Cosmochimica Acta* **238**: 477-495. doi: [10.1016/j.gca.2018.07.010](https://doi.org/10.1016/j.gca.2018.07.010)

In revision

12. **Grewal, D.S.**, Sun, T., Aithala#, S., Hough T.#, Dasgupta, R., Yeung, L., Schauble, E. (202x) Limited nitrogen isotope fractionation during core-mantle differentiation. *Geochimica et Cosmochimica Acta*

In review

13. **Grewal, D.S.**, Asimow P.D. (202x) Origin of the superchondritic C/N ratio of the bulk silicate Earth.

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INVITED SEMINARS AND COLLOQUIA

- *Department of Earth and Environmental Science at the University of Minnesota - Twin Cities* (December 2022)
- *Division of Geological and Planetary Sciences, California Institute of Technology* (November 2022)
- *Gordon Research Conference - Deep Carbon Science* (June 2022) [Cancelled due to COVID-19]
- *Bayerisches Geoinstitut (BGI), University of Bayreuth* (June 2022)
- *Department of Earth, Planetary and Space Science, University of California, Los Angeles* (March 2022)
- *Department of the Geophysical Sciences, University of Chicago* (January 2022)
- *School of Earth and Planetary Sciences, National Institute of Science Education and Research (NISER), India* (January 2022)
- *Geological Society of India, Regional Center – Indian Institute of Technology (IIT) Kharagpur* (November 2021)
- *Prebiotic Chemistry and Early Earth Environments Consortium Seminar Series* (August 2021)
- *Geodynamics Research Center, Ehime University* (June 2021)
- *University of Cambridge (Geochemistry group)* (June 2021)
- *Le Centre de Recherches Pétrographiques et Géochimiques (CRPG) Nancy* (April 2021)
- *University of California, Riverside (Biogeochemistry group)* (April 2020)

PRESENTATIONS AT SCIENTIFIC MEETINGS AND CONFERENCES

(* designates presenting author, # designates supervised interns)

31. **Grewal, D.S.***, Dasgupta, R., Aithala, S.# The effect of carbon concentration on its core-mantle partitioning behavior in inner Solar System rocky bodies. *American Geophysical Union Fall Meeting* (December 2021) [ORAL]
30. **Grewal, D.S.***, Dasgupta, R., Hough T.#, Farnell, A.# Rates of protoplanetary accretion and differentiation set nitrogen budget of rocky planets. *American Geophysical Union Fall Meeting* (December 2021) [ORAL]
29. **Grewal, D.S.***, Dasgupta, R., Marty, B. A very early origin of nitrogen in inner Solar System protoplanets. *Goldschmidt Conference* (July 2021) [ORAL] **Invited**
28. Dasgupta, R.*, **Grewal, D.S.**, Hough T.#, Farnell, A.# (2021) Nitrogen depletion in the inner Solar System planets linked to the rates of protoplanetary accretion and differentiation. *Goldschmidt Conference* (July 2021) [ORAL]
27. **Grewal, D.S.***, Dasgupta, R., Marty, B. A very early origin of nitrogen in inner Solar System protoplanets. *Lunar and Planetary Science Conference* (July 2021) [ORAL]
26. **Grewal, D.S.***, Dasgupta, R., Marty, B. A very early origin of nitrogen in inner Solar System protoplanets. *Habitable Worlds Workshop* (February 2021) [POSTER]
25. **Grewal, D.S.***, Dasgupta, R. Magma Ocean differentiation regime in the earliest formed rocky bodies - Internal or External? *Habitable Worlds Workshop* (February 2021) [POSTER]
24. **Grewal, D.S.***, Dasgupta, R., Aithala, S.# The effect of bulk carbon on its core-mantle partitioning behavior. *American Geophysical Union Fall Meeting* (December 2020) [ORAL]

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23. Dasgupta, R., **Grewal, D.S.*** Magma Ocean differentiation regime in the earliest formed rocky bodies inferred from volatile abundances in iron meteorites. *American Geophysical Union Fall Meeting* (December 2020) [ORAL]
22. **Grewal, D.S.***, Dasgupta, R. The Effect of Differentiation via Internal Versus External Magma Oceans on the Carbon and Nitrogen Budgets of Rocky Planets. *Goldschmidt Conference* (June 2020) [ORAL]
21. **Grewal, D.S.***, Hough T.[#], Dasgupta, R., Aithala, S.[#] Protoplanetary Differentiation is the Primary Cause of Nitrogen Depletion in Bulk Silicate Reservoirs of Rocky Bodies. *Lunar and Planetary Science Conference* (March 2020) [ORAL] *Cancelled due to COVID-19*
20. **Grewal, D.S.***, Dasgupta, R., Hough T.[#] The core-mantle partitioning of carbon and nitrogen in carbon-undersaturated ultramafic systems. *American Geophysical Union Fall Meeting* (December 2019) [POSTER]
19. **Grewal, D.S.***, Hough T.[#], Dasgupta, R. The core-mantle partitioning of nitrogen in carbon-undersaturated ultramafic Systems. *Goldschmidt Conference* (August 2019) [ORAL]
18. Dasgupta, R.*, **Grewal, D.S.**, Tsuno K. Control of Accretion and Early Differentiation Process on the Diversity of Volatile Inventory of Rocky Solar System Objects. *Goldschmidt Conference* (August 2019) [ORAL]
17. Dasgupta, R.*, **Grewal, D.S.**, Tsuno K. Origin of Life-essential Volatile Elements in Rocky Planets – Insights from Accretion and Early Differentiation of Inner Solar System Objects. *Astrobiology Science Conference* (June 2019) [ORAL]
16. **Grewal, D.S.***, Dasgupta, R., Holmes, A.K.[#], Costin, G, Li Y., Tsuno K. The fate of nitrogen during core-mantle separation. *Lunar and Planetary Science Conference* (March 2019) [ORAL]
15. **Grewal, D.S.***, Dasgupta, R., Farnell, A.[#], Hough T.[#], Costin, G, Tsuno K, Li Y., Holmes, A.K. The compositions of the early atmospheres formed by magma ocean degassing. *Lunar and Planetary Science Conference* (March 2019) [POSTER]
14. Dasgupta, R., **Grewal, D.S.***, Sun, C., Tsuno, K., Costin, G. The Origin of Earth's Major Volatiles via Accretion of a Large Planetary Embryo. *Lunar and Planetary Science Conference* (March 2019) [POSTER]
13. **Grewal, D.S.***, Dasgupta, R., Farnell, A.[#], Hough T.[#], Costin, G, Tsuno K, Li Y., Holmes, A.K. Evolution of the C/N ratio of the Bulk Silicate Earth as a probe to understand the roles of volatile accretion and differentiation. *American Geophysical Union Fall Meeting* (December 2018) [POSTER]
12. Dasgupta, R.*, **Grewal, D.S.** Origin and Early Differentiation of Carbon and Associated Life-Essential Volatile Elements on Earth. *American Geophysical Union Fall Meeting* (December 2018) [POSTER]
11. **Grewal, D.S.***, Dasgupta, R., Holmes, A.K.[#], Costin, G, Li Y., Tsuno K. The fate of nitrogen during core-mantle separation on Earth. *Goldschmidt Conference* (August 2018) [ORAL]
10. **Grewal, D.S.***, Dasgupta, R., Costin, G, Tsuno K, Li Y., Holmes, A.K.[#] Evolution of the C/N ratio of the Bulk Silicate Earth as a probe to understand the roles of volatile accretion and differentiation. *Gordon Research Conference* (June 2018) [POSTER]
9. **Grewal, D.S.***, Dasgupta, R., Sun, C., Tsuno K., Costin, G. Delivery of Carbon, Nitrogen and Sulfur to the **Silicate** Earth. *Carbon in the Solar System Workshop* (April 2018) [ORAL]
8. **Grewal, D.S.***, Dasgupta, R. The origin of volatiles on Earth. *Pre-IRESS Workshop, Rice University* (February 2018) [ORAL]
7. **Grewal, D.S.***, Dasgupta, R., Sun, C., Tsuno, K. Simultaneous alloy-silicate fractionation of carbon, nitrogen, and sulfur at high pressures and temperatures: Implications for establishing the volatile budget of the Earth. *American Geophysical Union Fall Meeting* (December 2017) [ORAL]

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6. Tsuno, K.*, Dasgupta, R., **Grewal, D.S.** The effects of sulfur on carbon partitioning and solubility in high pressure-temperature alloy-silicate systems: Implications for fractionation of carbon and sulfur during accretion and core formation of Earth and Mars. *American Geophysical Union Fall Meeting* (December 2017) [ORAL]
5. **Grewal, D.S.***, Dasgupta, R., Sun, C., Tsuno, K., Costin, G. Delivery of Carbon, Nitrogen and Sulfur to the Silicate Earth by a Giant Impact. *Deep Carbon Observatory Extreme Physics and Chemistry Workshop, Arizona State University* (November 2017) [ORAL]
4. Tsuno, K.*, Dasgupta, R., **Grewal, D.S.** The effects of sulfur on carbon partitioning and solubility in high pressure-temperature alloy-silicate systems. *Deep Carbon Observatory Extreme Physics and Chemistry Workshop, Arizona State University* (November 2017) [POSTER]
3. **Grewal, D.S.***, Dasgupta, R., Sun, C., Tsuno, K., Costin, G. Delivery of Carbon, Nitrogen and Sulfur to the Silicate Earth by a Giant Impact. *Graduate Interdisciplinary Earth Science Symposia, Rice University* (November 2017) [ORAL]
2. **Grewal, D.S.***, Dasgupta, R., Tsuno, K. Simultaneous alloy-silicate fractionation of carbon, nitrogen, and sulfur at high pressures and temperatures: Implications for establishing the volatile budget of the Earth. *Gordon Research Conference* (June 2017). [POSTER]
1. Tsuno, K.*, Dasgupta, R., **Grewal, D.S.** The effects of sulfur on carbon partitioning and solubility in high pressure-temperature alloy-silicate systems. *Gordon Research Conference* (June 2017). [POSTER]

SELECTED POPULAR MEDIA COVERAGE

- *Our Nature Geoscience* (2021) was covered by [Universe Today](#), [CosmoQuest](#), [Science Daily](#), [Centauri Dreams](#), [Space Daily](#), [Newswise](#), [Phys.org](#), and [Scienmag](#), amongst other news outlets.
- *Our Nature Astronomy* (2021) was covered by [Many Worlds](#), [EOS](#), [TechExplorist](#), [Medium](#), [Science Daily](#), [Phys.org](#), [Sciencenewsnet](#), and [SciTechDaily](#), amongst other news outlets.
- Our *Science Advances* (2019) paper had one of the highest altimetric score of research published in geochemistry/planetary science ([1435](#); top 0.02% of all research papers ever tracked) with press release being covered by 161 news outlets across the globe including [CNN](#), [BBC](#), [The Guardian](#), [Daily Mail](#), [Spain's News](#), [Times of India](#), [China Daily](#), [Phys.org](#), [Universe Today](#), [Space Daily](#), [Sky News](#), [Space.com](#), [Yahoo News](#), [USA Today](#), [Vice](#), [Science Daily](#), [Gizmodo](#), [Sky & Telescope](#), [The Wire](#), and [Inverse](#).

SCIENCE ARTICLES

- **Grewal, D.S.**, Furtney, M. When planets collide: Origin of life on Earth. *The Science Breaker* (under review)
- **Grewal, D.S.**, Lv, M., Dorfman, S. Press Release - *Extreme Physics and Chemistry Community Workshop, Arizona State University, USA. Deep Carbon Observatory* (November 2017)

SYNERGISTIC ACTIVITIES

Academic

- | | |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2022 | Convener of the session “Accretion and differentiation of rocky planets from interdisciplinary perspectives” <i>American Geophysical Union Fall Meeting</i> (December 2022) |
| 2021 | Co-organizer, CLEVER Planets Seminar Series |
| 2020 | Panelist, Session: Forming Habitable Worlds, Habitable Worlds 2021 Workshop |

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2017-Present Reviewer for *Earth and Planetary Science Letters*, *Geochemical Perspectives Letters*, *Geochimica et Cosmochimica Acta*, *Journal of Geophysical Research: Planets*, *Nature Communications*, and *Science Advances*

Non-academic

2021 Member of Unlearning Racism in Geosciences (URGE) Admissions and Hiring Policies Group, Rice University, Houston (USA)
2021 Member of URGE Policies for Working with Communities of Color Group, Rice University, Houston (USA)
2021 Volunteer Speaker for Department of Earth, Environmental and Planetary Sciences, O-Week Academic Fair, Rice University, Houston (USA)
2012-15 Volunteer teacher, Tibetan Village Children's School, Suja (India)
2012-14 Volunteer student recruiter and teacher, Pehal Charitable Trust, Patiala (India)

PRACTICAL AND ANALYTICAL PROFICIENCY

Performing high P-T experiments using piston-cylinder and multi-anvil apparatus, Electron Probe Micro Analyzer (EPMA), Fourier Transform Infrared Spectroscopy (FTIR), Raman Spectroscopy, programming in MATLAB, and Secondary Ion Mass Spectrometry (in collaboration with others)

TEACHING EXPERIENCE

2020 Lecturer for ESCI 114 – Discoveries in Earth, Environmental and Planetary Sciences
2019 Lecturer for ESCI 114 – Discoveries in Earth, Environmental and Planetary Sciences
2018 Guest Lecturer for ESCI 412/612 – Advanced Petrology
2012-16 Lectures on undergraduate level Physical, Organic and Inorganic Chemistry to more than 800 students for engineering, medical and science university entrance examinations
2012-16 Lectures on Physical, Organic and Inorganic Chemistry for International and National Chemistry Olympiads

RESEARCH SUPERVISION

2022 Paras Choudhary (undergraduate from Indian Institute of Technology, Kharagpur)
2019-20 Melinda Zhou (high school student from Mayde Creek High School, Katy)
2019-20 Sanath Aithala (undergraduate from University of Houston)
2019 Naod Araya (undergraduate thesis co-supervisor at Rice University)
2019 Ryan Anselm (high school student from Clemens High School, Sugarland)
2018-19 Alexandra Farnell (high school student from St. John's School, Houston)
2018-19 Taylor Hough (undergraduate student from Brown University)
2017 Rohil P. Bathija (high school student from Awty International School, Houston)
2016-18 Alexandra K. Holmes (undergraduate thesis co-supervisor at Rice University)

GEOLOGICAL FIELD EXPERIENCE

2017 Study of volcanic eruption deposits and collecting xenoliths, South California, USA
2015 Study of volcanic deposits in the Cascades, USA
2011 Structural mapping of a complex metamorphic terrain in the Eastern Ghats Province, Angul (Eastern India)

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| 2010 | Reconstruction of Paleocurrent direction and Paleostratigraphy in the Rewa Basin, Madhya Pradesh (Eastern India) |
| 2010 | Strike mapping and ore volume estimation in an underground Uranium mine, Jaduguda (Eastern India) |
| 2009 | Mapping in a sedimentary-metamorphic terrain of the Singhbhum Shear Zone Jharkhand (Eastern India) |
| 2008 | Structural mapping and identification of deformation structures in a Precambrian orogenic belt, Ghatshila (Eastern India) |

MEMBERSHIP WITH PROFESSIONAL SOCIETIES

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| 2018-Present | Geochemical Society |
| 2016-Present | American Geophysical Union |