Thomas Subak

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Education

Northwestern University, Evanston, IL
Doctor of Philosophy (in progress)
Department of Earth and Planetary Sciences, Advisor: Elvira Mulyukova
GPA: 3.88/4.00
Colgate University*,* Hamilton, NY
Bachelor of Arts, May 2023, *summa cum laude*
Major: Astrogeophysics (with honors); Minor: Mathematics
GPA: 3.64/4.00 Major GPA: 3.74/4.00
Dean's Award for Academic Excellence (3), with Distinction (3)
National University of Singapore Approved Exchange Program, Spring 2022
Independent semester of study at the National University of Singapore with coursework in atomic physics and mathematics.

Research Experience

Research Assistant, Fall 2023 - Present
Northwestern University, Department of Earth, Environmental, and Planetary Sciences
Microstructural Conditions for Shear Localization at a Transform Plate Boundary, Advisor: Elvira Mulyukova
Using theoretical methods to estimate deformation conditions in the lithosphere. Developing a microphysical model that can be compared with field, laboratory observations and determine shear zone structure with depth.
Research Worker, Fall 2023 - Present
Northwestern University, Department of Earth, Environmental, and Planetary Geosciences
Synthesis of Ferropericlase for High Pressure Experiments and Characterization, Advisor: Steven Jacobsen
Reconstructed and operated vertical tube gas mixing furnace for precise diffusion synthesis of (Mg,Fe)O (ferropericlase). Determined composition through XRD, cut and polished samples for experimentation, participated in XFEL experiment to determine thermal diffusivity at high pressures and temperatures.
Senior Undergraduate Thesis, Spring 2023
Colgate University, Department of Earth and Environmental Geosciences
Volumetric Analysis of Martian Chaos Terrain, Advisor: Joe Levy
Continuation of summer research. Used ArcGIS to map surface features and interpolate volume data of Martian chaos. Analyzed and visualized the data using R in conjunction with literature to investigate formation processes.
Research Assistant, Summer 2022
Colgate University, Department of Earth and Environmental Geosciences
Water Tracks in McMurdo Dry Valleys/Martian Chaos Mapping, Advisor: Joe Levy
Studied Antarctic dirt samples to better understand meltwater processes relating to water tracks. Filtered, diluted, and tested samples before using Ion Chromatography to test the effect of cation exchange on the brine. Used R to examine the relationship between organic matter, soluble salt data collected from IC and ICP-Mass Spectrometer, and electrical conductivity. Used ArcGIS to map chaos features on Mars. Analyzed datasets with R for the objective of determining the formation process.
UROPS Student Researcher, Spring 2022
National University of Singapore, Centre for Quantum Technologies, Quantum Optics Group
Seismic Sensing with Deployed Optical Fibers, Advisor: Christian Kurtsiefer
Designed and constructed a simple Michelson interferometer to better understand how interferometry could improve oceanic seismometry. Background lit review of approximately thirty textbooks and articles to better

understand optical concepts and practical applications. Weekly journal club with group to discuss modern optical concepts in-depth and strategize group project direction.
Research Assistant, Summer 2020
Colgate University, Department of Earth and Environmental Geosciences
Seismicity in Alaskan Subduction Zones, Advisor: Aubreya Adams
Analyzed geophysical data using MATLAB to map large scale earthquakes and study their relationship to subduction zones. Read papers and proposals for an exploration of academic research processes.

Teaching Experience

Teaching Assistant (EARTH 202/Earth 215), Winter 2025, Fall 2025
Northwestern University, Department of Earth, Environmental, and Planetary Geosciences
Instructed and graded lab sessions for undergraduate students. Designed and wrote one lab. Consulted on course planning and held weekly office hours. Gave several short lectures pertaining to research/expertise.
Teaching Assistant (Phys 111), Fall 2021
Colgate University, Department of Physics and Astronomy
Administered group peer tutoring sessions of 10 students once a week. Emphasized collaborative learning through problem sets for greater understanding of course material.
Mathematics Tutor, Fall 2021, Fall 2022
Colgate University, The Center for Learning, Teaching, and Research
Assisted students individually with coursework from calculus, linear algebra, and number theory.

Science Outreach and Engagement

REACH Board Member, Fall 2024 - Present
Mentorship Opportunities for Research Engagement, Northwestern University
Connected with local high school educators to organize graduate student panels for students interested in science. Facilitated participation with graduate student volunteers to match researchers with student interests.

Student Ambassador, Spring 2021-Fall 2023
American Physical Society
Connected directly with campus students to spread information about APS and opportunities it provides. Strategized with team on how to promote opportunities to pursue diversity, equity, and inclusion goals.
Co-Founder and Co-President, Fall 2021-Spring 2023
Colgate University, Colgate Student Society for Atomic, Molecular, and Optical Physics
Planned organization and meetings with the goals of educating and spreading enthusiasm about Atomic, Molecular, and Optical Physics to students of both scientific and non-scientific academic backgrounds.

Technical Skills

Programming Languages**:** Advanced proficiency in Matlab, proficient in R, Python (ML experience in Python).
Software**:** Proficient in LaTEX, ArcGIS, and Microsoft Office.
Laboratory: Experience with diamond anvil cells, raman spectroscopy, X-Ray diffraction, EDM drilling of gaskets, thin-section polishing, and sample analysis through mass spectrometry.

Publications

Levy, J. S., **Subak, T. F.**, Armstrong, I., King, I., Kuang, L., Kuentz, L., Gearon, J. H., Naylor, S., Rapoza, M. C., & Wang, H; Martian Chaos terrain fracture geometry indicates drainage and compaction of laterally heterogeneous confined aquifers. *Icarus*, 426, 116377. (2025) https://doi.org/10.1016/j.icarus.2024.116377

I.C. King, J.T.E. Johnson, L. Kuang, S. Naylor, **T. Subak**, A.M. Koleszar, J.S. Levy; Brine formation in cold desert, shallow groundwater systems: Antarctic Ca-Cl brine chemistry controlled by cation exchange, microclimate, and organic matter. *GSA Bulletin,* (2024) doi: https://doi.org/10.1130/B37251.1