Zeyang Sun, Ph.D.

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Research Interests

I am an isotope geochemist focusing on paleoclimate, mass extinction mechanisms, terrestrial environments, and carbonate preservation and diagenesis. My research primarily employs mass spectrometry for stable and clumped isotope analysis, alongside theoretical modeling of physical and chemical processes. My long-term goal is to study geochemical proxies and the co-evolution of environment and ecology throughout Earth's history. I'm also interested in orbitrap mass spectrometer for studying various clumped isotopologues and their applications.

Education

Ph.D. **Department of Geology and Geophysics, Texas A&M University** 2024
Geology
Dissertation: Carbonate Clumped Isotope Reordering from an Atomic Approach: Heating Experiment, Kinetic Modeling, and Application
Advisor: Ethan Grossman

B.S. **School of Earth Sciences and Engineering, Nanjing University** 2017
Geology (Hons)
Thesis: Geochemical Features of Carbonates from Gaoyuzhuang Formation and Tieling Formation of North China: Implications for the Redox Conditions of Paleo-Ocean
Advisor: Hong-Fei Lin

Professional Experience

Graduate Assistant Researcher in Clumped Isotope Geochemistry 2017 – 2024
Department of Geology and Geophysics, Texas A&M University
Advisors: Ethan Grossman, William Defliese (Co-advisor, 2017 – 2019)

Research Internship in Metal Isotope Geochemistry Jul – Sep 2016
Department of Earth and Planetary Sciences, Yale University
Advisors: Noah Planavsky, Xiangli Wang (Co-advisor)

Publications (*Denotes Equal Contribution)

Accepted & Published

[3] **Sun*, Z.**, Perez-Beltran*, S., Zaheer*, W., Defliese, W. F., Banerjee, S., and Grossman, E. L.: Clumped isotope reordering kinetics in strontianite and witherite: experiments and first-principles simulations, *Earth and Planetry Science Letters* 624, p. 118467, 2023. DOI: 10.1016/j.epsl.2023.118467.

[2] Perez-Beltran*, S., Zaheer*, W., **Sun*, Z.**, Defliese, W. F., Banerjee, S., and Grossman, E. L.: Density functional theory and ab initio molecular dynamics reveal atomistic mechanisms for carbonate clumped isotope reordering, *Science Advances* 9, eadf1701, 2023. DOI: 10.1126/sciadv.adf1701.

[1] **Sun, Z.**, Wang, X., and Planavsky, N.: Cr isotope systematics in the Connecticut River estuary, *Chemical Geology* 506, pp. 29–39, 2019. DOI: 10.1016/j.chemgeo.2018.12.034.

In Progress

[4] Cold low-latitude Ordovician paleotemperatures may be in hot water, *Proceedings of the National Academy of Sciences*, in revision.

[3] Reordering mechanisms in aragonite revealed by ab initio molecular dynamics, in prep.

[2] Sources and migration of fluids involved in genesis of Mississippi Valley type ores, in prep.

[1] Carbonate clumped isotope resetting kinetics facilitated by internal water and organic matter, in prep.

Presentations

Conference Submissions

[7] **Sun, Z.**, Perez-Beltran, S., Defliese, W. F., Banerjee, S., and Grossman, E. L.: Reassessment of calcite clumped isotope preservation using water-facilitated clumped isotope resetting, Oral, in: *Goldschmidt*, Chicago, IL, USA, Aug. 2024.

[6] **Sun, Z.**, Perez-Beltran, S., Defliese, W. F., Banerjee, S., and Grossman, E. L.: Revisiting clumped isotope resetting in calcites with internal water and organic matter, Oral, in: *International Clumped Isotope Workshop*, Long Island, NY, USA, Aug. 2024.

[5] **Sun, Z.**, Maupin, C. R., Perez-Beltran, S., Zaheer, W., Defliese, W. F., Banerjee, S., and Grossman, E. L.: The role of internal water in carbonate clumped isotope resetting, Oral, in: *GSA Connects 2023 Meeting*, Pittsburgh, PA, USA, Oct. 2023.

[4] **Sun, Z.**, Defliese, W. F., and Grossman, E. L.: The kinetics of clumped isotope reordering of synthetic inorganic carbonates, Poster, in: *AGU Fall Meeting*, New Orleans LA, USA, Dec. 2021.

[3] **Sun, Z.**, Defliese, W. F., and Grossman, E. L.: The kinetics of clumped isotope reordering of synthetic inorganic carbonates, Poster, in: *GSA Connects 2021 Meeting*, Portland, OR, USA, Oct. 2021.

[2] **Sun, Z.**, Defliese, W. F., and Grossman, E. L.: The kinetics of clumped isotope reordering of synthetic inorganic carbonates, Flash Talk, in: *Goldschmidt*, Lyon, France (Virtual), July 2021.

[1] **Sun, Z.**, Defliese, W. F., and Grossman, E. L.: Reconstructing thermal histories of the Oklahoma, Illinois and Moscow basins using clumped isotopes of mid-Carboniferous brachiopods, Poster, in: *International Clumped Isotope Workshop*, Los Angeles, CA, USA, Jan. 2019.

Honors and Awards

[6] **Student Research Award (2nd Place)** 2024
Geology and Geophysics Graduate Society Symposium, TAMU

[5] **ConocoPhillips/HEEP Endowed Graduate Fellowship** 2022
Department of Geology and Geophysics, TAMU

[4] **Petroleum and Sedimentary Systems Scholarship**, Berg-Hughes Center, TAMU 2018

[3] **Honor of Outstanding Graduate**, Nanjing University (NJU) 2017

[2] **Pandeng Earth Sciences Scholarship** 2015
NJU and Institute of Geology and Geophysics, Chinese Academy of Sciences

[1] **Qihang Earth Sciences Scholarship**, School of Earth Sciences and Engineering, NJU 2014

Teaching Experience

Teaching Assistant

[2] Prepared lab session materials, explained the principle of the IRMS and the carbonate device, and trained students to perform carbonate clumped isotope analysis for class projects.
Course: GEOL 648 Stable Isotope Geology (Spring 2024 and 2022, Fall 2018), TAMU
Project: Clumped Isotopes of Modern Benthic Foraminifera (Spring 2024)

[1] Prepared class materials, addressed questions, guided experimental design and instrument use, and provided tutoring in data analysis and visualization using the Julia language.
Course: GEOL 450 Geology Senior Project & GEOS 405 Environmental Geosciences (Spring 2023), TAMU
Project: Impact of Gas Stove Usage on Indoor Air Quality and Health

Professional Engagement and Activities

Reviewer

[1] Science Advances / Chemical Geology / Palaeo3

Outreach

[3] Geology and Geophysics Undergraduate Summer School, TAMU 2024
Topic: *"How to Give an Oral Presentation and Academic Conference Experiences"*
Activity: I discussed with summer school undergraduates how to deliver effective research presentations and shared insights from my academic conference experiences, which helped students successfully present their summer school projects.

[2] Chemistry Open House for Students, Kids, and Families, TAMU 2019, 2018
Topic: "*The Thermometer in a Shell*"

Activity: I showcased collections of brachiopod and mollusk shells to students, kids, and families and introduced them to the 'thermometer' within these shells. I presented simple diagrams illustrating atomic structures, the concept of isotopes, the temperature-isotope relationship, and a mass spectrometer. Finally, I engaged kids and students in hands-on experiments, like mixing vinegar and baking soda to generate bubbles and CO_2 gases, to give them an initial experience as geochemists.

[1] Ions@WORK Mass Spectrometry Symposium and Mass Spectrometry for Isotopic Analysis Subunit Open House, TAMU (News Link) 2018

Activity: I paticipated in the lab tour and introcued the instruments in the Stable Isotope Geosciences Facility (SIGF) to the symposium audience.

Field Trips

[2] Permian Reef Complex and Guadalupe Mountain, USA 2018

[1] Late Ordovician Outcrops, Cincinnati Arch Region, USA 2018

Skills

Instrument Techniques Including operation, troubleshooting, maintenance, and training

[1] Thermo Scientific™ 253Plus IRMS

[2] Thermo Scientific™ Kiel IV Carbonate Device with a customized PPQ Trap

[3] Field Emission SEM, CL Microscopy, FTIR Microscopy

[4] High Temperature Conversion Elemental Analyzer

[5] Manual Glass Vacuum Line

Programming Julia, Python, MATLAB®

Doctoral Program Courses

[9] CHEM 648 Principles of Quantum Mechanics Fa 2019

[8] OCNG 641 Inorganic Aquatic Geochemistry Sp 2019

[7] GEOL 648 Stable Isotope Geology Fa 2018

[6] CHEM 621 Chemical Kinetics Sp 2018

[5] GEOL 658 Earth Systems Through Deep Time: Global Change, Paleoclimate, and Life Sp 2018

[4] OCNG 689 Cenozoic Paleoclimate Sp 2018

[3] OCNG 655 Experimental Design and Analysis in Oceanography Fa 2017

[2] OCNG 640 Chemical Oceanography Fa 2017

[1] GEOL 681 Stable Isotope Methods and Research: Clumped Isotope Fa 2017

Referees

Ethan Grossman, Professor and Michel T. Halbouty Chair
Institute: Department of Geology and Geophysics, Texas A&M University
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Sarbajit Banerjee, Professor and Davidson Chair in Science
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Yige Zhang, Professor
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