# Natasha Sekhon (she/her/hers)

*Department of Earth, Environmental and Planetary Sciences &*
*Institute at Brown for Environment and Society*
*Brown University, RI, 02918*
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## Primary Research Interests

Terrestrial climate change, abrupt climate change, speleology, karst hydrology, low-temperature stable isotopes, trace element geochemistry, environmental sciences, Holocene and Quaternary hydroclimate, multivariate and big data statistical analysis, science and society, science communication

## Academic Appointment

2021 – Present *Voss Postdoctoral Research Associate & Presidential Diversity Postdoctoral Fellow*
Department of Earth, Environmental and Planetary Sciences & Institute at Brown for Environment and Society
Brown University, RI

2021 – Present *Visiting Scientist*
Department of Earth, Atmospheric, and Planetary Sciences
Massachusetts Institute of Technology, MA

## Education

2021 *Ph.D*., Geological Sciences, Department of Geological Sciences, Jackson of Geosciences, University of Texas at Austin, TX

2016 *M.S.,* Geological Sciences, Institute of Geophysics, Jackson of Geosciences, University of Texas at Austin, TX

2014 *B.S.,* Earth System Sciences (Honors), University of California Irvine, CA
Minor in *Comparative Literature*

2013 University of California Education Abroad Program (UCEAP), University of Edinburgh, Scotland, UK

## Publications

*Published*

10. **Sekhon, N.,** C.P.C. David, M.C.M. Geronia, M.J.G. Custado & D.E. Ibarra, *2022,* "Investigating the response of hydrological processes to El Niño events using a 100-year dataset from the western Pacific Ocean." *Journal of Hydrology: Regional Studies* DOI: doi.org/10.1016/j.ejrh.2022.101174

9. David, C.P., M.J., Custado, **N. Sekhon** & D.E. Ibarra, 2022, "Forecasting tropical ENSO-induced drought conditions using sea surface heights in the Western Pacific." *All Earth.* DOI: 10.1080/27669645.2022.2089484

8. **Sekhon, N.,** D.M. Tremaine, J. L. Banner, & D. O. Breecker. "Mapping atypical and typical stalagmite morphologies using high resolution X-Ray computed tomography as a non-destructive and rapid test for paleoclimate suitability." *In Print* at *Journal of Cave and Karst Studies.* (PDF Available)

7. Gallagher, T., L. Serach, **N. Sekhon,** H. Zhang, H.Wang, S. Ji, C. Xi, H Lu, & D.O. Breecker, *2021,* "Regional patterns in Miocene-Pliocene aridity across the Chinese Loess Plateau revealed by high resolution records of paleosol carbonate and occluded organic matter." *Earth and Planetary Science Letters.* DOI: doi.org/10.1029/2021PA004344

6. **Sekhon, N.,** V. F. Novello, F. A. Cruz, B.E. Wortham, T.G.R. Ribeiro, & D. O. Breecker, *2021,* "Diurnal to seasonal cave ventilation in Brazilian Caves." *Global and Planetary Change.* DOI: 10.1016/j.gloplacha.2020.103378

5. **Sekhon, N.,** T. Beach, S. Krause, & S. Eshleman, *2020,* "Understanding climate trends in Central America through practical problem-based learning." *Journal of Geography in Higher Education.* DOI: 10.1080/03098265.2020.1833318

4. Griffiths, M.L., K.R. Johnson, F.S.R. Pausata, J.C. White, G.M. Henderson, C.T. Wood, H. Yang, V. Ersek, C. Conrad **& N. Sekhon**, *2020*, "Mid-to-Late Holocene Megadroughts in the Middle Mekong Basin Linked to Global Climate Changes." *Nature Communications.* DOI: 10.1038/s41467-020-17927-6

3. Oster, J. L., S. F. Warken, **N. Sekhon,** M. M. Arienzo, & M. Lachniet, *2019*, "Speleothem Paleoclimatology for the Caribbean, Central America, and North America." *Quaternary.* DOI: 10.3390/quat2010005

2. Comas-Bru, L., S.P. Harrison, M. Werner, K. Rehfeld, N. Scroxton, C. Veiga-Pires, & **SISAL Working Group Members,** *2019*, "Evaluating model outputs using integrated global speleothem records of climate change since the last glacial." *Climate of the Past.* DOI: 10.5194/cp-15-1557-2019

1. Atsawawanunt, K, S. Harrison, L., Comas-Bru, **& SISAL Working Group Members**, *2018*, "The SISAL database: a global resource to document oxygen and carbon isotope

records from speleothems." *Earth System Science Data.* DOI: 10.5194/essd-10-1687-2018

*In Review*

2. **Sekhon, N.,** J. L. Banner, D. O. Breecker, B. A. Black, & N. R. Miller. "Moving towards an understanding of transition metal variability controls in stalagmites: An assessment in sub-annually resolved 20$^{th}$-century stalagmites from semi-arid southwestern United States." at *Geochimica et Cosmochimica Acta.*

1. Fohlmeister, J., **N. Sekhon,** A. Columbu, K. Rehfeld, L. Sime, C. Veiga-Pires, N. Marwan, & N. Boers. "Global reorganization of atmospheric circulation during Dansgaard-Oschger cycles." at *Proceedings of the National Academies of Sciences.*

*In Progress*

4. **Sekhon, N.,** M. Jones, R. Bosch, S. Burgess, K. Osimiri, L. Naylor & A. Garcia. "A global perspective in understanding the value of carbonate critical zones to local communities" *Earth's Future* (Call for "The Future of Critical Zone Science: Towards Shared Goals, Tools, Approaches and Philosophy")

3. **Sekhon, N.,** J. W. Partin, R. L. Edwards, H. Cheng & T. M. Quinn. "Multidecadal rainfall variability in the South Pacific Convergence Zone using the geochemistry of stalagmites from the Solomon Islands" *Paleoclimatology and Paleoceanography*.

2. **Sekhon, N.,** J. L. Banner, D. O. Breecker, N.R. Miller & D. M. Tremaine. "A two-year source to sink monitoring study to interpret elemental and isotopic variability in a karst system in southeastern New Mexico." *Journal of Hydrology*.

1. Weiss, A.M., R.C. Martindale, D.O. Breecker, **N. Sekhon**, E.J. Ramos, J. Oefinger, A. Kosir, & N.R. Miller. "An enigmatic dissolution surface at the Paleocene/Eocene boundary on a shallow carbonate platform, Slovenia." For *Geology.*

## Research Funding

PI, National Geographic Level 1 Grant Application, *Investigating the changing landscapes in northern South America during the Mid-Holocene through the framework of human and climate interactions*. **Pending** $19,991.

Karst Records 9 Travel Grant, Karst Records Meeting, 2022, $884.

Co-PI, National Cave and Karst Research Institute Seed Grant, 2021-2022, *Utilizing Stalagmites from the Philippines (USPS): Quantifying and understanding interannual hydroclimate variability in the Philippines through cave monitoring and stalagmite analyses.* $24,991.

PI*, Voss Postdoctoral Research and Presidential Diversity Postdoctoral Fellowship.* Brown University. $4,000.

Geological Society of America Graduate Student Research Grant, 2020, $1,375.

National Cave and Karst Research Institute Fellowship for Research, 2019, $5,000.

Jackson School of Geosciences Match Grant, 2019, $1,000.

Patty Daw Memorial Grant, 2019, $752.

Cleveland Grotto Science Fund, 2018, $1,610.

DeFord Field Scholarship, 2018, $1,500.

Jackson School of Geosciences Match Grant, 2018, $1,000.

Graduate Research Grant for Cave and Karst Research, 2017, $2,000.

Jackson School of Geosciences Match Grant, 2017, $1,000.

DeFord Field Scholarship, 2017, $1,500.

Geological Society of America Graduate Student Research Grant, 2017, $1,750.

Muehlberger Field Scholarship Off-Campus Summer Research, 2015, $1,500.

ANSTO Grant, 2nd Summer School in Speleothem Sciences, 2015, $1,500.

## Teaching

| Year | Role | Course | No. Of Pupils | Responsibilities |
|---|---|---|---|---|
| | | *Institute at Brown for Environment and Society, Brown University* | | |
| Fall 2022 | Co-Instructor | ENVS00700G: Historical climatology and global climate change | 1 x 20 | Co-developed and -taught course aimed at undergraduate students to introduce paleoclimatology, (historical) climatology, and Python coding exercises. *Syllabus available.* |
| | | *Department of Geological Sciences, University of Texas at Austin* | | |

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|---|---|---|---|---|
| Spring 2020 | Teaching Assistant | GEO 302E: Earth, Fire, Wind | 3 x 20 | Taught 3 laboratory sections. Designed and taught exercises focused on introductory geology topics with a focus towards non-geology majors. |
| Spring 2017 | Teaching Assistant | GEO 302C: Climate: Past, Present, Future | 2 x 15 | Taught 2 laboratory sections with a focus on climate dynamics. Course is aimed at geology major junior – sophomore undergraduates. |
| Fall 2016 | Teaching Assistant | UGS 303: Sustaining a Planet | 4 x 20 | Taught 4 laboratory sections. Graded lab sections and essays. Class also counted towards a writing requirement for incoming freshman. |

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*Department of Geography and the Environment, University of Texas at Austin*

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| Spring 2018 | Guest Lecture | GRG 333K: Climate Change | 25 | Designed and taught a course on using readily available climate data to understand climate trends through the lens of the Maya. |
| Fall 2018 | Guest Lecture | GRG 339: Process Geomorphology | 30 | The exercise was implemented through Guest Lectures aimed at junior undergraduate students. The end results were published in a pedagogy journal. |

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*Environment Science Institute, University of Texas at Austin*

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| Spring 2018 | Field Teaching | EVS 311: Field Seminar in | 40 | Co-led with fellow TA Lily Serach, field trips across central and southeastern Texas. Responsibilities included help with designing, grading labs, logistics for travel, and collaboration with institutes such as the Marine |

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| Assistant | Sustainability | Science Institute, Biology and Ecology Department at UT, Austin Energy, Barton Springs Watershed to name a few. |

## Fellowships/ Honors/ Awards

2022 Brown's Postdoctoral Excellence Award for Research/Teaching

2021-Present *Voss Postdoctoral Research and Presidential Diversity Postdoctoral Fellowship.* Brown University. ~$130,000

2020-2021 *Graduate Student Continuing Fellowship.* University of Texas at Austin $2,500 x 12 months

2017 *Jackson School of Geosciences Independent Study Fellowship.* University of Texas at Austin

2014 *Outstanding Senior in Earth and Environmental Sciences.* University of California at Irvine.

2014 *Honors in Earth System Sciences.* University of California at Irvine.

2014 *Chancellor's Award for Excellence in Research.* University of California at Irvine.

2014 *Phi Betta Kappa Honor Society.*

2012-2013 *Maria Rebecca and Maureen Bellettini Award.* UCEAP

Dean's List: Winter 2012, Spring 2012, Spring 2013, Fall 2013, Winter 2014, Spring 2014

## Seminar Talks

(** Invited)

9. ******Cagayan Museum and Historical Research Center, *Tuguegarao City, Philippines,* April 2022.

8. ******Brown Alumni Club of Hawaii, Back to Class Technical Event with Prof. Ibarra and Dr. Sekhon, *Virtual,* March 2022.

7. ******Department of Geology, Geography, and Environmental Studies, Fall Seminar Series, *Mount Holyoke,* November 2021.

6. Department of Earth, Environmental and Planetary Sciences, Climate and Environment Seminar, *Brown University,* November 2021.

5. ******School of Geosciences, Geosciences Seminar Series, *University of Louisiana at Lafayette,* April 2021.

4. ******Department of Geology, Palmer Geology Lecture Series, *Kent State University*, March 2021.

3. ******Environmental Studies Program, *University of Portland*, February 2021.

2. Department of Geological Sciences, Water, Climate, and Environment Seminar, *University of Texas at Austin*, November 2018.

1. ******Austin Geological Society Symposium, May 2016.

## Mentoring Experience

6. *Christina Marsh.* B.A. Candidate in Environmental Analysis, Pomona College, Class of 2023. Brown's Leadership Alliance Research Experience for Undergraduate (LANS) student (June-August 2022) from Pomona College, CA. Christina will be reconstructing Holocene paleoclimate utilizing stable isotope records of a stalagmite from Colombia.

5. *Annabelle Gao.* B.S. Candidate in Geology-Chemistry, Brown University, Class of 2023. Trace element analyses and sample preparation for Holocene stalagmite from the Philippines.

4. *Nayong Hur.* The University of Texas at Austin. Class of 2019. Senior Thesis: Coupling geomorphology and nutrients. Primary Advisor: Dr. Paola Passalacqua. Now at Lynker Technologies.

3. *Rachel Wright.* The University of Texas at Austin. Class of 2018. Senior Thesis: Correlating growth banding in Texas speleothems: Paleoclimate Implications. Primary Advisor: Dr. Jay Banner

2. *Kara Posso.* The University of Texas at Austin. Class of 2017. Senior Thesis: Geochemical and physical response of central Texas cave drip water to changing climate conditions. Now at Zara Environmental Consulting.

1. Field work to Sitting Bull Falls, NM. Organized and led undergraduate and graduate students to Sitting Bull Falls, New Mexico from 2017 - 2020. Close interaction with National Forest Service rangers at the Lincoln National Forest, Guadeloupe Section, New Mexico and researchers at the National Cave and Karst Research Institute. Over Summer 2018 and 2019, led high-school students from Carlsbad High School for fieldwork experience.

## Field Work

| Year | Role | Location | Responsibilities |
|---|---|---|---|
| 2022- Present | Primary Co-ordinator | Philippines | Field campaign working with collaborators in the Philippines to set up cave monitoring networks in three caves (2 National Parks and 1 State Land) for monthly cave variable collection. Responsible for all logistics planning and scientific questioning. |
| 2017-2020 | Primary Co-ordinator | New Mexico | Set up and led bi-monthly to bi-weekly trips to Sitting Bull Falls for active cave, stream, rainfall monitoring. Responsible for all logistics planning and scientific questioning. |
| 2017-2021 | Primary Co-ordinator | Texas | Led monthly cave monitoring trips to Inner Space Caverns, Westcave, Natural Bridge Caverns, Cave Without A Name for cave monitoring. Trained undergraduate students for the same. Part of Dr. Banner's Central Texas cave monitoring expeditions. |
| Spring 2018 | Graduate Field Assistant | Central Texas | Karst Hydrogeology field course that involved setting up LTC loggers, ISCO deployments, dye tracing with charcoal, stream discharge measurements. PI: Dr. Marcus Gary |
| May-June 2016 | Field Assistant | Northwestern Belize | Assisted with soil excavation pits in wetlands, sampling for radiocarbon and stable isotope analysis, tree IDs using DFW, water sampling, |

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| | | | sieving anthropological sites to investigate Environmental Changes in the Maya Lowlands. PI: Dr. Tim Beach. |
| November 2015 | Graduate Field Assistant | Gulf of Mexico | CDT sediment traps redeployment and maintenance on R/V Point Sur with PhD student Kaustubh Thirumulai. PI: Dr. Terry Quinn. |
| January - April 2014 | Undergraduate Field Assistant | Sequoia National Park, CA | Bi-monthly cave monitoring trip to Crystal Cave with PhD student Staryl Mc-Gabe. PI: Dr. Kathleen Johnson. |
| May - June 2013 | Student | Scotland | Learned basic geologic field mapping skills in the Scottish Highlands as part of the Inchnadamph Field Course. |

## Selected Conference Abstracts (#Talk | *Poster | ^Undergraduate Student)

13. ^ Marsh,C., **N. Sekhon,** T. Beach, D. McGee & D.E. Ibarra. Late Holocene hydroclimate changes recorded in $\delta^{18}O$ of a stalagmite from Cueva De La Fabrica, Colombia**.** GSA Fall 2022 Meeting

12. **Sekhon, N.,** A. Gao^, J.W. Partin, S. Mallick & D.E. Ibarra. Advancing standardization of carbonate LA-ICP-MS analyses using a speleothem sample from the tropic**.** GSA Fall 2022 Meeting

11. **Sekhon, N.,** C.P.C. David, M.C.M. Geronia, M.J.G. Custado & D.E. Ibarra. A 100 Year Paired River Discharge and Rainfall Data Investigation Into Tropical Droughts in the Philippines Over Interannual Timescale**.** #Asia Oceania Geosciences Society 2022 Virtual

10. **Sekhon, N.,** A. Gao^, J.W. Partin, S. Mallick & D.E. Ibarra. In-situ trace element analyses of a speleothem from the tropics to track paleoflood events through the Holocene. *KR9 Climate Change Meeting 2022

9. **Sekhon, N.,** C.P.C. David, M.C.M. Geronia, M.J.G. Custado & D.E. Ibarra. Tropical drought and El Niño: historic and future river discharge analysis of the Philippine archipelago. *AGU Fall 2021 Meeting

8. **Sekhon, N.,** J. L. Banner, D. O. Breecker, D.M. Tremaine & N.R. Miller. Monitoring a unique karst system over two-years (2017-2019 CE) to elucidate hydroclimate variables influencing the geochemistry of surface and sub-surface waters. #GSA Fall 2021 Meeting

7. Fohlmeister, J., **N. Sekhon,** A. Columbu, K. Rehfeld, L. Sime, C. Veiga-Pires, N. Marwan, N. Boers. Global reorganization of atmospheric circulation during Dansgaard-Oschger cycles. *EGU 2021 Meeting - Online due to Covid-19

6**. Sekhon, N.,** J. L. Banner, D. O. Breecker. A two-year source to sink monitoring study to interpret elemental and isotopic variability in a karst system in southeastern New-Mexico. #GSA Fall 2020 Meeting - Online due to Covid-19

5. Fohlmeister, J., N. Boers, N. Marwan, A. Columbu, K. Rehfeld, **N. Sekhon**, L. Sime, C. Veiga-Pires. Composite data set of last glacial Dansgaard/Oeschger events obtained from stable oxygen isotopes in speleothems. *EGU 2020 Meeting

4. **Sekhon, N.,** J. L. Banner, D. O. Breecker, B. A. Black, N. R. Miller. High-Resolution Stalagmite Reconstruction Examining Local Hydroclimate Variability From A Shallow Cave in Semi-Arid New Mexico. #GSA Fall 2019 Meeting

3. **Sekhon, N.,** J. L. Banner, N.R. Miller, P.E. Carlson, D.O. Breecker. Seasonally resolved trace element concentrations in stalagmites from a shallow cave in New Mexico. *AGU 2017 Fall Meeting

2. **Sekhon, N.,** J. L. Banner, D. Breecker, P.E. Carlson. Near entrance Speleothems: Archives of seasonality? #GSA South-Central Conference 2017

1. Breecker, D. O. & **N. Sekhon.** Global Stacking of Speleothem Carbon and Oxygen Isotope Records. #KR8 Conference 2017

## Workshops

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| Carbonate Critical Zone Florida Workshop | April 4-6, 2022 |
| SISAL 5th Workshop Virtual Participant | Feb. 28- March 4, 2022 |
| Carbonate Critical Zone Virtual Workshop | August 2020 |
| Introduction to Remote Sensing for Tribal Lands | October 6-29, 2020 |
| HYSPLIT Workshop Participating Member (online) | June 22-25, 2020 |
| SISAL 4th Workshop Participant (Xi'an, China) | October 14-18, 2019 |
| SISAL 3rd Workshop Participant (Agadir, Morocco) | October 8-12, 2018 |
| 2nd Summer School in Speleothem Sciences (Oxford, UK) | August 21-27, 2015 |

## Press Coverage

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| Institute at Brown for Environment and Society Bi-Monthly Feature Article | 2022 |
| The Northern Forum, Features Article with Benjamin De Yro, Philippines | 2022 |

Today@Brown: Postdoctoral Excellence Awards Announced ,USA 2022
National Cave and Karst Research Institute Magazine, USA 2019-2020
National Cave and Karst Research Institute Magazine, USA 2017-2018

## Service

### Peer Review

International Journal of Speleology, Journal of Geography, Geochimica et Cosmochimica Acta, Geology, Rapid Communications in Mass Spectrometry, Chemical Geology

### Disciplinary

GSA Annual Meeting Session Co-Chair 2022
Co-Charing two topical sessions with Drs. Daniel Jones and Lewis Land; T140. Karst Hydrology and Hydrogeology; T142. Karst Sedimentary, Paleoclimate, and Historical Records

Pal(a)eoPERCS Committee 2021-Present
A virtual seminar series designed to share research, build collaborations and strengthen the diverse and global paleo community. The series focuses on the research of Early Career Researchers in paleo- (ntology, ecology, ceanogrphy, climate).

GSA Karst Division Representative 2021-Present
Duties include the promotion of the Karst Division during Geological Society of America meetings with booth set up and interaction with attending audience, participation in monthly meetings with the board, budget discussions, award distribution selection.

Skype A Scientist Participating Member 2017-Present
Interacted with students at various K-12 levels across North America. As a participant, I give a 40–50-minute lecture on climate change, paleoclimatology, introduction to geology, followed by questions and informal discussion with students. The lecture is prepared in collaboration with the teachers. I have participated in 3 sessions in English in the United States and 2 sessions in French in Canada.

SISAL North America Regional Coordinator 2017-Present
Work with members of the North America regional team, led by Prof. Jessica Oster, to organize, compile, and interpret existing published stalagmite records from North and Central America. SISAL is a PAGES funded initiative to increase interaction between researchers interested in paleoclimatology, karst, and stalagmites.

3rd Summer School in Speleothem Sciences 2015-2017
Part of the organizing committee that consisted of speleothem graduate students from across the world. Our aim was to organize a successful and engaging Summer School in Speleothem Sciences held at CENIEH, Burgos, Spain.

**Departmental**

Brown Postdoc Council 2021 - Present
Member of Brown Postdoc Council where the steering committee has weekly meetings to discuss activities both professional development and community building amongst postdocs at Brown. As Academic Co-Chair with fellow postdoc Dr. Adrian Thompson, we are working on developing postdoc workshops geared towards academia and non-academia for Spring and Summer 2022.

Science Y'All Blog 2017-2021
Editorial Board member for UT Austin's Geoscience Blog. Pitch and write stories that cover a wide range of geoscience topics, geared towards a wider audience. Examples of my contribution: Example 1, Example 2, Example 3

Water, Climate, Environment Informal Seminar 2018-2019
Co-organizer with fellow graduate student, Alison Tune, of UT Austin's geoscience seminars focused on Water, Climate, and Environment research theme.

Explore @ University of Texas at Austin 2019-2021
Every year, UT Austin welcomes families, teachers, and students from across Texas to discover research activities. Volunteered with the Jackson School of Geosciences.

Summer Statistics School Teaching Assistant 2017-2021
Teaching assistant with UT Austin's Summer School of Statistical Studies. Courses TA'd include Intro to Data Analysis and Graphics Using R, Introduction to SQL and Relational Database Design, Questionnaire Design and Analysis

**Community**

Mentor at Communities in School (CIS) of Central Texas 2020-2021
High School Math Tutor and Mentor for students with the aim of encouraging students to reach their full potentials. CIS is a high-school dropout prevention national endeavor.

Writer for numerous outlets - Science Y'All, Envirobites, NewU 2012-2020

Austin Cave Festival Volunteer 2018-2020

Radio Host volunteer at KVRX, 91.7 FM, Austin, TX 2017-2021
Radio Host at KVRX, 91.7 FM, Austin, TX 2015-2017
Radio Host at KUCI, 88.9 FM, Irvine, CA 2013-2014
The primary focus of my radio shows has been to expose multicultural music with roots deep in the geosciences with themed shows, interviews with fellow graduate students, artists, and musicians.

## Academic Advisors

Post-Doc: *Dan E. Ibarra*, Brown University
Ph.D.: *Dan O. Breecker & Jay L. Banner*, University of Texas at Austin

M.S.: *Terry M. Quinn & Jud Partin*, University of Texas at Austin
B.S.: *Kathleen R. Johnson*, University of California, Irvine
*Alexander Tudhope,* University of Edinburgh

## Professional Societies

Geological Society of America, American Geophysical Union, National Speleological Society, PAGES

## Skills

*Communication:* public speaking, writing articles for general audience, radio hosting

*Computer:* Python (Proficient), ArcGIS (Intermediate), MySQL Workbench (Intermediate), LaTex (Intermediate), ImageJ (Intermediate), Adobe Creative Suite (Illustrator, InDesign, Photoshop) (Intermediate)

*Laboratory:* Drilling carbonates (paleosols, stalagmites, corals, forams) using a dental drill, Dremel, and New Wave micromill and CNC mill setup, preparing, analyzing, and reducing data of carbonate samples for traditional stable isotopes using an IRMS (MAT253, Delta Thermo V) attached to a KIEL III, IV, Gas Bench, water sample analyses using an IRMS attached to a continuous flow Gas Bench ($\delta^{18}O$) and TCEA ($\delta D$), sample preparation for organic carbon $\delta^{13}C$ and $\delta^{15}N$ using an EA attached to an IRMS, water sample preparation (diluting and pipetting) for solution mode ICPMS with a Quadruple sample introduction for trace element concentrations, stalagmite sample preparation, analysis and data reduction (LA-tools package for Python) for LA-ICP-MS analysis of trace element concentrations, preparation of modern cave calcite growth analysis for traditional isotopes and trace element analysis, Confocal Fluorescent Laser Microscope and XRCT imaging of stalagmite sections/cores, XRD analysis, U-Series column chemistry.

*Field:* ISCO and LTC deployments in surface waters, cave-air monitoring for $CO_2$,temperature, relative humidity variability, cave dripwater monitoring set up to collect dripwaters, calculate drip rate to quantify epikarst processes, Ultrameter II for water temperature, pH, TDS, conductivity measurements, modern cave calcite plate deployments to measure modern cave precipitation variability, proficient in surface and cave water and soil sampling, hand held coring equipment to extract stalagmite cores, belay and lead climbing certified

*Languages:* English (Native, C2), Hindi (Native, C2), Punjabi (Native, C2), French (Working or Conversational, B2), Spanish (Working or Conversational, B2), Scottish Gaelic (Beginner, A1)